VOL. I.

ABDOMINAL INJURIES
TO
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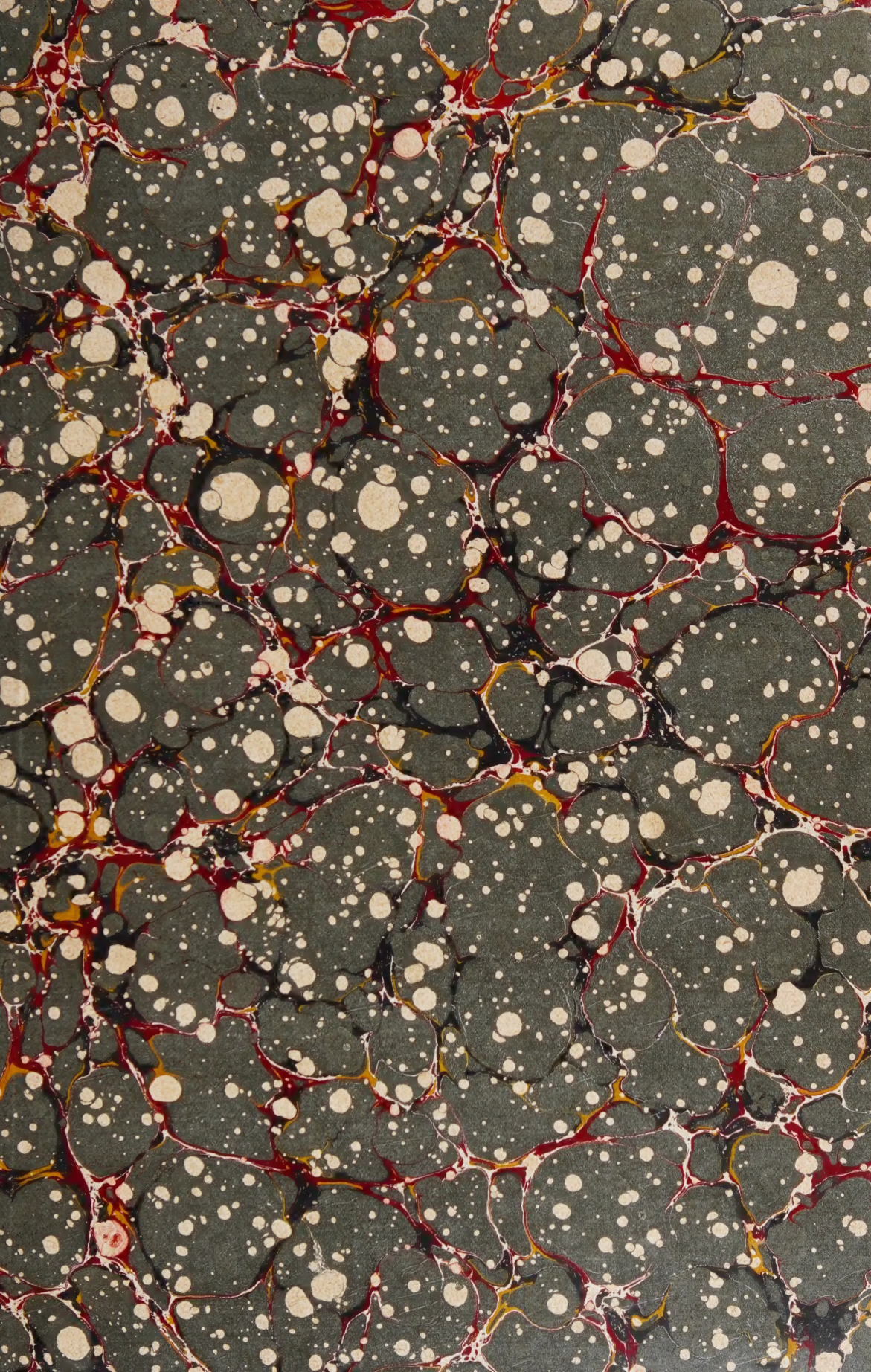

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SAJOUS'S

ANALYTICAL CYCLOPÆDIA

OF

PRACTICAL MEDICINE

BY

CHARLES E. de M. SAJOUS, M.D.

AND

ONE HUNDRED ASSOCIATE EDITORS

ASSISTED BY

CORRESPONDING EDITORS, COLLABORATORS
AND CORRESPONDENTS

Illustrated with Chromo-Lithographs, Engravings and Maps

Third Revised Edition

VOLUME I

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RESPECTFULLY DEDICATED

TO THE

AMERICAN MEDICAL PROFESSION

AS AN

EXPRESSION OF DEVOTION.

THE EDITOR.

PREFACE.

It was to assist the general practitioner that the ANNUAL OF THE UNIVERSAL MEDICAL SCIENCES was started. What its life-history has been need hardly be told; that over five hundred thousand volumes have been distributed in the United States alone, sufficiently indicates the generous reception accorded it, while the encouragement given the editor, especially by his colleagues of the medical press, can but be recalled with pleasure.

The last ten years, however, have been prolific in changes on every side. The intense activity displayed in all departments of medicine, the multiplicity of divisions and subdivisions in medical nomenclature, the ever-increasing value of time and the stringency of available pecuniary resources have greatly modified the circumstances surrounding a physician's existence and his needs. Although the ANNUAL had become a much appreciated work of reference for authors and teachers, the general practitioner, for whom it had been especially created, failed to find in its columns the kind of assistance he required. Often disappointed because every disease, or subdivision of a disease,—pathology, treatment, etc.,—could not be reviewed each year, owing to the fact that the subjects had not received the attention of writers, he condemned the work *in toto*, overlooking the origin of the omission. Again, he found the work too voluminous for current reading,—the very mass of progressive work appalled him!

A careful analysis of the whole question revealed the underlying cause of trouble,—namely, that articles made up of heterogeneous excerpts fail to excite interest, and, as a result, soon fatigue the intellect of the reader. Whenever a new line of thought is introduced, the subject modified by the new point adduced must be recalled and former propositions tending to transform both the older and the newer conceptions of the subject must be simultaneously considered and, as it were, digested. That the sum of intellectual labor required, if the progressive feature advanced is at all to prove profitable, must be arduous, is evident; that such labor gradually engenders a disinclination to utilize the kind of literature involving it is a conclusion which deductive reasoning can but sustain. Briefly, the ANNUAL had made for itself a place among writers, teachers, and investigators, but, for the reason given, it had not satisfactorily fulfilled its mission among family physicians, for whose benefit it had been especially planned.

Overworked, overburdened, and often poorly paid, general practitioners, especially those exercising their calling in country-districts, share but little in the enjoyments of life. Harassed, ever anxious, their moments of respite

are but opportunities for Nature, and, in enforcing her rights, she subdues functional activity to insure recuperation. In her way, therefore, she prepares their powers for the morrow and thereby contributes her share to their beneficent labors. But, we have seen, scientific progress also has its claims, and the sufferer is entitled to the resources of medicine, not as they *were,* but as they *are.* The duty of the medical editor, therefore, lies between Nature's requirements as regards the physician, and the claims of justice as regards suffering humanity. Both, it was thought, could be subserved by presenting even scientific literature in an attractive, entertaining, easily-understood form, with professional dignity as a constant guide.

These general principles have formed the basis of a modified work, which is now placed before the profession. Instead of presenting the excerpts from the year's literature arranged in order under a general head as before, each disease—including its subdivisions: "Etiology," "Pathology," "Treatment," etc.—is described *in extenso,* and the new features that the year has brought forth are inserted in their respective places in the text. In this manner the reader is saved all fatiguing study: he has before him what in the older work was left to his memory.

The work, when completed, will present all the general diseases described in text-books on practical subjects—medicine, surgery, therapeutics, obstetrics, etc.—and, inserted in their logical order in the text, all the progressive features of value presented during the last decade. This will remove the cause of dissatisfaction caused by the absence of general subjects in the older work. If the year brings forth nothing new upon any particular disease, the latter will, at least, appear as it was when last studied, whether this be one, two, five, or twenty years before. The general arrangement adopted will make it possible to cover the entire field in six volumes. As may be seen in any medical dictionary, the subjects treated in the first volume represent exactly one-sixth of the whole.

While the general practitioner's needs will thus be adequately provided for, authors and teachers will not have to deplore the change. Instead of having at their disposal only the reviews of a single year, as before, they will have those of practical value published during the last ten years. The article of "Abdominal Injuries," for instance, contains one hundred and sixty article excerpts besides the general text; that on "Appendicitis," a still larger number. Being interpolated in the text and controversially arranged, the abstracts either sustain the views advanced or indicate fields as yet insufficiently explored. This arrangement necessarily precludes chronological order; indeed, no attempt has been made to treat the various subjects historically, the aim being to give them an essentially practical form.

So great an amount of matter from different sources would seem to insure a degree of confusion tending greatly to increase the reader's labors. This is avoided by using large type for the general text—that is to say, the description of a disease—and small type for the excerpts from journals. Either may thus be read separately. If, for instance, the reader desires to merely review the general subject, he has but to read the text in large type; if he wishes to

analyze or study a disease, operative procedure, drug, etc., in which he is particularly interested, he has but to include the small-type text in his perusal of the article.

So complete a rearrangement of the entire text could hardly be successfully carried into effect unless the editor could take part in the work of preparation. He therefore concluded that it would be best to have the majority of the sections prepared under his immediate supervision and to submit them to the members of the associate staff for revision and correction. Each editor enjoying the privilege of erasing, changing, or adding anything he chose, the correctness of the views presented was thus insured, while the innovations could be satisfactorily carried into effect. How carefully the associate editors have fulfilled their share of the labor can be judged from the character of the several articles bearing their names. The sections which have been prepared *in toto* by associates are those on "Addison's Disease," "Angina Pectoris," "Astigmatism," "Actinomycosis," "Anthrax," "Acetonuria," "Albuminuria," "Alcohol," "Antipyrine," "Atropine," "Belladonna," "Blepharitis," and "Bright's Disease." As may be seen, the members of the associate staff have again placed the editor under great obligation, and he wishes to express to them his deep gratitude. Drs. Witherstine and G. Archie Stockwell, of Philadelphia, and Dr. Arthur Turner, of Paris, have in other directions contributed to facilitate the editor's task and have placed him under many obligations.

The unsigned articles have not been submitted to associates. The more important ones, such as "Acetanilid," "Animal Extracts," etc., were written by the editor, while the others were prepared under his immediate supervision. The editor also selected the abstracts for all the articles; any error of judgment on that score must, therefore, be ascribed to him alone. Only the excerpts thought to convey practical information have been incorporated; but this feature of the work will be given further development.

The classification adopted is, to a certain degree, a novel one, general subjects alone appearing in the list. In other words, individual symptomatic manifestations, such as asthenopia, aphonia, bradycardia, etc., have not been given separate sections, but have been considered under the diseases of which they form part. This has made it possible to save considerable space, which has been utilized for the elaboration of subjects that are scantily considered in text-books, notwithstanding their great practical importance. "Abdominal Injuries," for instance, so frequent since electric tramways, foot-ball games, and bicycling have come upon the scene, have been given over forty pages, while the various phases of "Alcoholism"—doubtless the greatest scourge of the human race—have been considered in an equally exhaustive manner. As to remedies, only those that are being generally utilized in a manner compatible with scientific precision and in accordance with professional ethics have been incorporated. The list includes a few new agents which seem to merit further trial. Obsolete remedies have not been mentioned, the aim being to present those which constitute a modern physician's armamentarium. Again, only the diseases in which the remedies mentioned are of special value

have been alluded to, along with what new points the recent literature may have afforded.

To facilitate the use of the work, the subjects have been arranged in alphabetical order, the references being given in full at the end of each abstract. The index and reference list, which occupied so much room in the older work, could thus be dispensed with.

The personal commentations contributed during the last ten years by the associate editors have been introduced when applicable, and many illustrious names—some of which recall departed friends, such as D. Hayes Agnew, Benjamin Ward Richardson, Dujardin-Beaumetz, J. Lewis Smith, Joseph O'Dwyer, and others—are thus perpetuated in the pages of the work.

In the 1896 issue of the ANNUAL the following statement was made: "The hard-worked practitioner is the protector of a correspondingly great number of human lives; to help him, therefore, in acquiring practical knowledge is to increase his fighting force,—*i.e.*, to help him in the accomplishment of his duty—a higher one than any other allotted to man." These words can be repeated to-day; they represent the foundation of the new ANNUAL AND ANALYTICAL CYCLOPÆDIA OF PRACTICAL MEDICINE, which the editor respectfully dedicates to the American Medical Profession as an expression of profound devotion.

The present edition includes not only the newer practical features contributed during the last three years that have seemed to the Central Staff to merit insertion, but the sections on the various drugs have been adjusted to the eighth decennial revision of the United States Pharmacopœia (1905).

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SAJOUS'S ANALYTICAL CYCLOPÆDIA OF PRACTICAL MEDICINE.

A

ABDOMEN, INJURIES OF THE.

Contusion.

Symptoms. — The symptoms attending a contusion of the abdomen, whether caused by blows, kicks, spent bullets, the passage of heavy bodies—such as vehicles—over the abdomen, etc., are not always such as to call attention to the seriousness of the lesion present. The gravest abdominal injuries may co-exist with practically no external or general indication of mischief, the patient walking a long distance, perhaps, without experiencing anything more than slight local pain where the blow had been received.

Case of traumatic rupture of the small intestine caused by a very slight blow which left no mark. Extensive peritonitis and free exudate were present six hours after the injury, although there was almost entire absence of symptoms apart from cessation of peristalsis and slight vomiting. J. J. Buchanan (Annals of Surg., Nov., 1900).

From observations of some twenty cases of visceral injury, following contusion of the abdomen, verified by operation or autopsy, the most prominent were pain, tenderness, and muscular rigidity, and likewise the most reliable. The deep-seated, localized pain following injury, especially increased by pressure, and accompanying local or general muscular rigidity, is one of the most constant signs of intra-abdominal injury. The association of these three symptoms is almost pathognomonic of abdominal irritation. Pain, however, is often present, with tenderness, in injuries limited to the abdominal wall; but in these instances muscular rigidity is generally absent. In the absence of subcutaneous pain localized tenderness with rigidity is strongly suggestive of visceral injury. Of the three symptoms, muscular rigidity is the most reliable, and sometimes the only sign. In the absence of other diseased conditions spasm of one or more of the abdominal muscles following the traumatism may be looked upon as Nature's effort to protect an injured organ from further irritation. Vomiting is a symptom often present, but not always an accompaniment of severe visceral injury. It is commonly present with involvement of the stomach and upper part of the intestinal tube, and with injuries resulting in severe shock. The signs of free fluid in the abdominal cavity are very suggestive. G. E. Brewer (Annals of Surgery, Feb., 1903).

The abdominal walls may be but slightly injured; but, again, the lesions may consist of extensive extravasations of blood between the layers, or sufficient laceration of the muscular and other tissues to give rise to more or less local sloughing. Such lesions of the abdominal wall, however, are not always accompanied by injury of the abdominal organs.

A trifling superficial injury of the abdominal wall may be associated with serious internal lesions, owing to the resistance offered by the abdominal walls and the fragility of the abdominal organs. The external appearances, therefore, should not be taken as a criterion.

Narrow bodies, the action of which is exerted on a small area, reach more deeply by overcoming resistance of the abdominal parieties more easily than larger bodies. Resistance varies with the age, state of obesity, and state of relaxation or contraction of the muscles. The direction of the blow is of importance. If perpendicular to the deeper structures, it is most harmful; when parallel, it tends to glide off; when oblique, the force is modified. Demons (Brit. Med. Jour., Nov. 27, '97).

A severe blow in the abdomen is likely to occasion either hæmorrhage or perforation. In hæmorrhage the pulse grows softer, while with perforation and extravasation the pulse hardens. Turner (Lancet, May 5, 1900).

In collapse or death from blows upon the epigastrium the solar plexus may be disregarded as a factor; the cause of collapse or death is the mechanical violence exerted upon the heart-muscle or its nerve-mechanism. G. W. Crile (Phila. Med. Jour., Mar. 31, 1900).

In the majority of cases, however, severe contusions of the abdominal wall, whether the deep organs are involved or not, are followed by agonizing pain in the region of the injury, restlessness, nausea or vomiting, marked prostration (indicated by a small, rapid, and irregular pulse), pallor (sometimes attaining lividity), cold sweats, rigidity of the abdominal wall, meteorism, anxiety, and fear of a fatal issue.

Diffused rigidity of the abdominal wall in a case of contusion of this region, even in the absence of any other serious symptom, is a decided indication for immediate laparotomy, while the absence of contracture, whatever may be the extent and gravity of the associated symptoms, contra-indicates surgical intervention. Of 10 cases in which, owing to the presence of this symptom, laparotomy was performed, this treatment proved successful in 9. Of 17 cases of severe abdominal contusion in which no operative treatment was applied in consequence of the absence of rigidity, all ended in recovery. Hartmann (Bull. et Mém. de la Soc. de Chir., Mar. 12, 1901).

All these symptoms bear the imprint of a severe nervous commotion, and, if the extensive distribution of the sympathetic nervous system in the abdominal cavity is borne in mind, the fact will become evident that symptoms usually witnessed immediately after the receipt of the injury are due mainly to the influence of the concussion upon the sympathetic supply. Sudden death has been known to follow a violent blow, especially when received in the region of the solar plexus.

The pain varies according to the location of the traumatism and the sensitiveness of the patient. Very severe at first, it usually becomes less marked after a few hours. It is greatly influenced by shock, profound prostration reducing its intensity by reducing sensation. Great restlessness usually accompanies abdominal pain after injuries, as well as during other diseases, such as appendicitis, when the suffering is due to a localized trouble. The pain may be radiated in various directions,—the shoulder, the umbilicus, the left axilla, the testicles, etc.,—according to the site of the primary lesion. Local tenderness is usually marked over the site of the traumatism.

The vomiting varies greatly in intensity from mere nausea to the most violent expulsive efforts, which are liable, by the strain upon the abdominal organs, to suddenly increase the extent of the lesions. The vomited matter sometimes contains blood, especially if the upper

portion of the digestive tract is involved in the injury. Constant and persistent vomiting tends to indicate a contusion accompanied by visceral lesions. According to Berndt, in simple cases the vomiting is repeated but two or three times. When the intestine is ruptured the vomiting is persistent and intractable and liver-dullness is absent.

The degree of shock depends upon the nature and extent of the injury and especially upon the amount of blood lost. When the signs of collapse gradually become more marked, internal hæmorrhage from rupture of one or more of the viscera is to be feared.

The pulse, usually rapid and weak at first, gradually becomes stronger and slower if a favorable reaction is about to take place. If, on the contrary, an unfavorable course is being taken and some complication is to occur, its rapidity and tension may become increased. Irregularity is not a favorable indication if it persists.

The temperature is independent of the pulse, except when a favorable reaction is taking place, when it may return to the normal line after having gone beyond or below it. The usual belief that a subnormal temperature always follows internal hæmorrhage is fallacious; for it may also be raised. The temperature, therefore, is of no value as a guide.

In abdominal injuries due to blunt force the symptoms are referable to the abdominal wall and cavity, or both. Pain may be severe or slight. As an early symptom vomiting is constant, distension may be slow or rapid, rigidity develops later, shock may or may not be present. The temperature and pulse, particularly the latter, are considered of great importance. Opium, even in small doses, renders the diagnosis of such injuries difficult, and should never be administered early. After an abdominal injury, if there is tenderness, acceleration of the pulse tending to increase ever so slightly, together with abdominal distension and a rise in temperature, the diagnosis of a grave injury is made absolute. In most cases but a few hours of close observation are required to establish the diagnosis. In such cases exploratory laparotomy should be performed at once unless the condition is so desperate that anæsthesia means certain death. Fowler (N. Y. Med. Jour., Aug. 19, '99).

In cases of abdominal contusion the surgeon before operating should wait for some symptom or symptoms indicative of intestinal injury. As in the presence of shock a diagnosis of intestinal injury cannot be made, the author would wait for reaction to take place. No one symptom is pathognomonic of intestinal injury, but the two most reliable are gradually increasing rigidity and an anxious, careworn, and painful expression of the face. The latter, which comes on after reaction has taken place and, it is supposed, is concomitant with development of peritonitis, is regarded as the most positive of all the symptoms of severe intra-abdominal injury. In the next group the author would place deep and perhaps radiating abdominal pain, respiration becoming more and more thoracic, vomiting after reaction, abdominal distension, increasing pulse-rate, and secondary fall in temperature. The subject of a severe abdominal contusion should, it is urged, be carefully and constantly watched. While advising delay in doubtful cases, the author does not mean that the surgeon should wait for serious symptoms to become so pronounced that a positive diagnosis is assured, for then operative intervention is, for the most part, too late. There is a position midway between operating on every case and waiting for an assured diagnosis, where the surgeon can say that, owing to the gradual appearance of certain symptoms, there is fair reason to think that the intestinal tract may be injured, and that an immediate operation will give the best chance. Le Conte (Annals of Surgery, April, 1903).

Hæmatemesis may assist in establishing the diagnosis of lesion in the stom-

ach or the upper portion of the intestinal tract, while the presence of blood in the stools may do the same as regards lesions of the intestines as a whole, including the colon. But, in itself, this symptom is, by no means, characteristic, since a violent strain may cause sudden engorgement of pharyngeal, gastric, rectal, or hæmorrhoidal vessels and then, several days after the accident, blood-rupture ensue. Even when present, streaks in vomited matter or stools are not always indicative of an alarming condition.

Blood in the urine is a more reliable sign of lesion in the urinary tract, especially the kidney and bladder. Anuria is also indicative of lesions in these organs; but, as shock frequently arrests the flow of urine, it is only valuable as a symptom after all symptoms of shock have passed.

Hæmorrhage into the orbits and from the ears are occasionally met with when the concussion has been very severe. This symptom does not necessarily indicate that the injury is an unusually dangerous one.

A few hours after the accident the pain usually becomes reduced; the patient may be more quiet and, perhaps, somnolent, although the pulse remains in its former condition. This period lasts between twelve and twenty-four hours. If at the end of this time there be no complication, a visceral lesion is probably not present. If, on the contrary, the symptoms gradually increase in intensity, the likelihood of grave injury is very great.

In the light of present knowledge, however, the practitioner should not delay active procedures until the patient's life becomes compromised by permitting the mechanical injury produced to start an infectious process, when the manner in which the injury was inflicted and the force applied tend to suggest serious internal lesion.

Diagnosis.—The diagnosis should primarily be based upon the history of the accident, the manner in which the injury occurred, the shape of the body, or bodies, by means of which the traumatism was inflicted, and the degree of percussive force applied, and, secondarily, upon the symptoms present.

Lesions of the Intestinal Tract.—Various theories have been advanced as to the manner in which rupture of the intestine is brought about, but experiments have shown that squeezing of the gut between the compressed abdominal wall and the vertebral column is the main mechanical factor brought into action. Crushing against the ilium is rarely produced. Another, although rare, cause of rupture is the presence, in the intestinal tract, of liquid or semi-liquid material, the sudden circumscribed pressure exerted upon the gut causing it to burst, through overdistension. The small intestine is the seat of lesion in 75 per cent. of the cases of rupture in the course of the intestinal canal. Hence the importance of carefully ascertaining in each case the direction from which the percussive force came, the intensity of that force, and the relative position of the organs between the site of pressure and the spinal column.

> The character of the force and the mode of its application always appear to be of much value as a help to diagnosis in most cases of intestinal injury, for it would seem that where the force is of diffused rather than of a localized character the injury is more likely to be extensive or even double. Thus, when a human being is run over, the wheel of a vehicle passing either over the abdomen or the back with the abdomen downward; when he falls from a height

upon a plank or beam; is trodden on by a horse; or is crushed between two obtuse bodies, it is most probable that either a solid viscus has been lacerated or that some portion of the small intestine has been torn in one or more places. Thomas Bryant (London Lancet, Dec. 7, '95).

Case of traumatic rupture of the intestine by indirect violence in a woman of 26 whose previous health had been good. While hurrying into her house to escape a thunderstorm she slipped and fell, striking the ground upon the right buttock. She had just eaten a hearty supper. No immediate alarming symptoms were noticed. She was awakened in the middle of the night by severe abdominal pains. The abdominal symptoms rapidly increased, and two days after the fall the patient was in a critical condition. The temperature was 104.3° F., the pulse 140. There was marked tympany.

The abdomen was opened; this was followed by an escape of cloudy fluid, but no gas. Upon separating the adhesions which had formed about the great omentum there was a gush of fluid heavily loaded with fibrinous flakes. The small intestine was distended and of a bluish-black color. A small perforation was discovered on the convex surface of the lower portion of the jejunum. This was sutured into the abdominal wound. The abdomen was drained. The shock of the operation was considerable, but on the second day there was improvement. The fistula persisted. Three months later, the fistula continuing to discharge, the patient had become alarmingly weak owing to the failure in assimilation of food, all efforts to heal the fistula having failed. A second operation was done, the fistula was closed, and the continuity of the gut restored. Recovery was rapid, and in the next few months she gained twenty-five pounds in weight. E. J. Senn (Amer. Jour. Med. Sciences, June, 1904).

Another factor of importance in establishing a diagnosis is the size of the instrument causing the injury. Lesions of the digestive canal, for instance, are usually the result of violent and sudden percussion produced by a body over a limited surface of the abdominal wall.

The predisposing factors are the presence of solid, semisolid, or fluid matter in the hollow viscera; leanness of the individual, and intestinal adhesions.

Any of the above accidental causes of injury being fulfilled, rupture of some portion of the gastro-intestinal tract is likely, especially if there is loss of consciousness at the time of the accident, followed by collapse, severe pain, a rapid and weak pulse, vomiting, tympanites due to the escape of intestinal gas into the abdominal cavity, and tenderness and rigidity of the abdominal walls. Such a diagnosis is further strengthened by hæmatemesis or bloody stools, the former tending to indicate a lesion of the stomach. Death occurs in 96 per cent. of such cases if unoperated.

Two signs which enable the physician to diagnose the occurrence of intestinal perforation before peritonitis has had time to manifest itself: first, distinctness of the murmurs of the heart and respiration during auscultation of the abdomen,—due to the presence of intestinal gases in the peritoneal cavity. Second, change in the pulse, which, at the moment of perforation, becomes accelerated, to slacken some hours later,—due to the absorption of putrid gases acting as cardiac poison. Gluzinski (Sem. Méd., Nov. 6, '95).

A ruptured intestine is probably present, though this is not certain, when, after a diffuse injury to the abdomen or a severe local injury as the immediate result of the accident, there is little collapse, and where vomiting soon becomes a prominent and persistent symptom, with lasting local pain and great thirst, with or without abdominal enlargement. Nineteen cases of rupture of the intestine adduced confirm the truth of this statement. Bryant (London Lancet, Jan. 11, '96).

Reviews of nineteen operations performed on patients who suffered from

rupture of the intestine, resulting from blows upon the abdomen. Not infrequently such injury will end fatally unless immediate operation is done. The abdominal viscera, although they have no bony wall to protect them in front, are protected from injury by their position, and by the immediate involuntary contraction of the abdominal muscles which takes place the moment a coming blow is seen or expected In injuries sustained through contests of physical strength, blows upon the abdomen are comparatively rare on account of the protected position in which the abdomen is held. The author comes, therefore, to the conclusion that where rupture of the intestine takes place, the intestine is generally caught between the body which causes the blow upon the abdomen and one of the bony structures which form its posterior walls. F. B. Lund (Boston Med. and Surg. Jour., Nov. 20, 1905).

Lesions of the Stomach.—Blows seldom cause rupture of the stomach, the elasticity of the organ, even when containing liquid or semiliquid material, being such as to cause it to escape injury under sudden impact or great pressure. It is also protected by the lower ribs, the liver, and the intestines. Nevertheless, this organ is occasionally involved in traumatism affecting other abdominal viscera. In the majority of cases the rent is found near the pyloric orifice, but the greater curvature may be the seat of the lesion, while the entire organ is occasionally torn from end to end. In the latter case, however, death ensues almost immediately in practically all cases. Pressure during lavage of the stomach may also cause laceration of the mucous membrane.

Case of a man who died in coma after several washings of the stomach for opium poisoning. At the necropsy several rents of the mucosa were found. Conclusion that the presence of the fluid was the cause of the injury, by pressure. Key-Aberg (Deutsche med. Zeit., Apr. 28, '92).

In the case of incomplete tears there may be hæmatemesis and severe localized pain resembling that of gastric ulcer,—gnawing and burning in character. This is followed by localized inflammation with tendency to the formation of adhesions. Hæmorrhage between the coats of the stomach may also occur in incomplete tears, a cyst-like pocket being formed.

Violent pressure upon the stomach may cause it to be crushed against the spinal column, and the mucous surfaces be lacerated by interpressure of the anterior and posterior walls of the organ. In such a case a marked lesion necessarily follows, giving rise to copious hæmatemesis.

Case of a boy who was caught between two freight-cars. Shock and vomiting of blood, but no external injury. Twelve hours after the accident the abdomen opened and a slight laceration in the spleen sutured. No other injury found. The autopsy showed two ruptures of the mucous membrane of the stomach,—one of the anterior wall about its middle and the other opposite to it in the posterior wall, the mucous membrane alone being stripped from the muscular layers. J. H. Clayton (Brit. Med. Jour., Mar. 24, '94).

The presence of rupture of the stomach can be ascertained by inflating the organ with hydrogen-gas through an elastic stomach-tube. If the organ be dilated by this procedure, penetration beyond the mucous coat is improbable. If the stomach cannot be distended, complete rupture has taken place, and tympanites, due to the presence of the gas in the cavity proper, will be recognized.

Rupture of the stomach implicates the peritoneal coat in the majority of cases, the elasticity of the peritoneal investment being less than that of the two internal coats: muscular and mucous. The contents of the stomach, or a por-

tion of them, escape into the peritoneal cavity and cause severe suffering and shock, followed promptly by death or septic peritonitis.

Lesions of the Liver.—The liver, owing to its friable nature, its size, and its anatomical position, is the organ most frequently injured, because indirect concussion may cause a profound lesion. A fall from a great height into water may thus cause a gaping rent of the capsule and parenchyma and open a large number of vessels. Severe and sudden blows of any kind, especially those involving much surface, over the abdominal wall may thus cause injury to this organ. Again, its softness, which may be increased by hypertrophy, causes it to yield readily to the crushing produced by carriage-wheels, car-bumpers, etc.

The severity of all the general symptoms is usually increased. The pain, when the liver is seriously injured, is peculiar; it radiates from the right hypochondrium to the waist, the scrobiculus cordis, or the scapular region. The respiration is generally embarrassed; there is marked shock. Examination of the fæces may show the absence of bile, especially if the bile-duct is ruptured: an occasional complication. The dissemination of bile in the system causes itching and, after a time, jaundice. The escape of bile into the peritoneal cavity may not give rise to peritonitis, however, this fluid being aseptic. A serous exudate may result from the irritation caused by its presence, forming a composite fluid which may be retained in the peritoneal cavity a considerable time.

> Case in which, after severe contusion in the hepatic region, swelling, with considerable rise of temperature, supervened. Incision in the median line. A cavity, from which about a quart of reddish fluid issued, found. Recovery. Lyonnet and Jaboulay (Lyon Méd., No. 10, '95).
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> Case of rupture of the liver in which there was copious exudation into the abdominal cavity. Urine containing bile; stools ash-gray. Seven quarts of dark mahogany-colored fluid withdrawn, and found to contain much biliary pigment, especially biliverdin. Recovery. Roux (Le Bull. Méd., Dec. 8, '95).

A rent is probable after a severe injury if there is collapse, if the pulse becomes more rapid and small, if the patient shows signs of exsanguinity, if the area of liver-dullness on percussion is increased, and if pain radiating to the scapular region is complained of. Severe injury may exist, however, without these indications.

> Case of a boy, aged 16, run over by a cart which had passed over his abdomen. The boy walked a quarter of a mile to the hospital. When admitted he was pale and in great pain, but his pulse was full; no external signs of injury. On the fifth day he had an action, accompanied with severe abdominal pain, speedily followed by collapse and sudden death. Fissure three inches deep was found in the right lobe of his liver. Thomas Bryant (Lancet, Nov. 2, '95).

Lesions of the Gall-bladder or Biliary Ducts. — Blows and other conditions capable of causing hepatic rents sometimes implicate these organs in the lesion. There may be severe pain in the right hypochondrium if a rupture exists, vomiting of food and bile, and icterus. The urine is usually dark-mahogany and the stools ash-gray in color. Tenderness over the hepatic region is usually marked. The intensity of the symptoms depend to a degree upon the quantity of bile voided into the abdominal cavity; but, this secretion being aseptic, peritonitis only occurs as a complication when the peritoneum is itself implicated

in the traumatism, or when the lesion is at the junction of the biliary tract and the intestinal canal, the latter in that case acting as a source of infection.

Case of a man who, after a severe blow in the right hypochondrium from the shaft of a cart, showed all the symptoms of rupture in the biliary tract. Seven quarts of a dark-brown liquid, rich in biliary pigments, biliverdin, etc., withdrawn on the fourth day by paracentesis. Prompt recovery. Jules Roux (Marseille-méd., Aug. 25, '95).

Case of rupture of the gall-bladder by contusion. Inflammation developed slowly and death resulted in three days. Post-mortem showed the patient had a large gall-bladder with numerous gall-stones. If an operation had been made early the chances would have been favorable. McLaren (Journal Amer. Med. Assoc., July 9, '98).

Lesions of the Spleen.—The causes of injury to this organ are the same as those of the liver. Rents, sanguineous infiltration, and partial crushing are the lesions most frequently observed. Enlargement of this organ through a malarial cachexia renders it susceptible to lesions which traumatism would not give rise to were it in its normal state.

In extensive lesions copious hæmorrhage usually takes place and death rapidly follows. If the lesion present is less severe, however, and the hæmorrhage be moderate, there is tendency to collapse, increasing pallor, and a feeling of suffocation. The latter symptom and severe radiating pain in the region of the spleen are generally present, besides the signs peculiar to all abdominal injuries. If the patient survives sufficiently long the immediate effects of the traumatism, peritonitis or abscess and other complications frequently result. Severe local pain generally continues for some time, and chills are not infrequent. Percussion shows the organ to be more or less enlarged.

Case of young man who fell from his horse and was struck on left side of thorax low down in the axillary line by animal's hind hoof. Brought to hospital in state of shock. Patient complained of considerable pain over the left side of the lower ribs, rather toward the back. Infusion of 1200 centimetres of sterile salt solution given. Next day symptoms of internal injury were apparent. Operation. The peritoneum purplish in color, bulged forward, and peritoneal cavity completely filled with blood-clots and fluid blood. Rupture of spleen found. Spleen removed, together with blood-clots in peritoneal cavity. At this stage of operation patient was in a moribund condition. Vein in arm was opened, and saline infusion of 2000 centimetres given. Recovery uneventful. Charles McBurney (Med. Record, Apr. 23, '98).

Four successful cases of splenectomy for rupture without external wound. Diagnosis of ruptured spleen is arrived at from (1) the locality of the injury; (2) the evidence of internal hæmorrhage, and (3) the large fixed dullness in the left flank. Ballance (Practitioner, Apr., '98).

In diagnosis of rupture of the spleen vomiting is a most important guide; in simple contusion of the alimentary tract it seldom, if ever, occurs.

After injury, the patient may be able to walk or drive for half an hour or even more. Then there is a feeling of acute pain in the splenic region, and a sense of extreme weakness. On examining the body the splenic region is tender, dull on percussion, and rigid. There is pain on deep inspiration, the breathing is short and jerky, and a fracture of the ribs may be suspected. Pain spreads over the abdomen; abdominal distension and rigidity become apparent, especially in the upper left quadrant of the abdomen. Symptoms of hæmorrhage now develop rapidly, pallor, extreme anxiety, thirst, small frequent pulse, and vesical tenesmus. Trendelenburg (Deut. med. Woch., Oct. 5, '99).

Enlargement and disease of the spleen greatly predispose to rupture. Hæmorrhage is the most constant symptom, though this may be caused by rupture of

the mesentery or liver. More characteristic and less constant is pain in the region of the spleen and of more importance is dullness of the percussion-note extending over the left upper abdominal and left lumbar regions. When let alone a rupture of the spleen is almost always fatal from hæmorrhage. Lewerenz (Archiv f. klin. Chir., B. 60, H. 4, 1900).

Lesions of the Kidneys.—The kidney is firmly held in place by its attachments, while its consistence is such as to preclude elasticity. Hence, a blow or undue pressure may cause rupture. All the causes of injury that may take part in the production of lesions elsewhere may also induce renal lesions, which may consist of contusion, rupture, or laceration.

Hæmaturia is valuable only as showing the fact of rupture of the kidney, but not as a symptom by which to decide on operating. It is not the visible loss of blood by the bladder, but the easily overlooked, but far more dangerous, bleeding into the perinephric tissues, or into the peritoneal cavity, that should receive the chief attention. W. W. Keen (Annals of Surg., Aug., '96).

Study of 5 personal cases and of 660 cases gathered from literature. The causes of rupture were varying, muscular action causing 10 per cent. The author was struck by the slight force necessary for rupture to take place. Blows over the front of the abdomen with the patient on his back was one of the causes of rupture. The kidney was never ruptured on one side with an accompanying injury to an organ on the opposite side. Intraperitoneal symptoms were usually due to rupture of the peritoneum. Tumor formation occurred in 143 cases. Hæmorrhage was the frequent cause of death. In all the cases there was a striking absence of injury to the omentum or the intestine.

Indications for operation: (1) marked and persistent hæmorrhage; (2) presence of a rapidly increasing tumor or area of dullness in the loin; (3) development of a tumor in the loin ten days or more after the injury; (4) immediate operation when there are signs of free fluid in the abdominal cavity; peritonitis or other peritoneal injuries. Watson (Trans. Amer. Assoc. of Genito-Urin. Surg.; Amer. Med., May 30, 1903).

Besides the symptoms common to severe abdominal traumatism there may be increased pain in the lumbar region with radiations in the direction of the pubis and rigidity of the muscles. Dullness on percussion is sometimes elicited. Anuria may also occur, but this is not a characteristic sign. Hæmaturia is an important indication of renal laceration, however, although it may not present itself at once; it may be followed by the appearance of pus. The catheter should be used in these. Retraction of the testicles is also said to occur (Rayer). The ureter is very rarely involved; when it is, the symptoms are not modified. Enlargement of the lumbar and hypochondriac regions is present in the majority of severe cases, but may supervene late in the history of the case.

Thanks to the compensatory work of the uninjured kidney, the mortality of renal lesions is not so marked as when other abdominal organs are injured.

Even severe wounds have been known to heal. If large renal vessels are torn, marked lividity occurs, the patient rapidly becoming exsanguine. Death may thus follow very soon. Involvement of the peritoneum in the injury is promptly followed by peritonitis, the signs of this affection appearing a few hours after the receipt of the injury. Sepsis is not an infrequent complication in unoperated cases.

Statistics of 118 cases published since 1878, 50 of which were fatal. In 14 of these the fatal result was due to primary, continuous, and secondary hæmorrhages combined with shock, while suppuration, including peritonitis, caused death in 16 cases. W. W. Keen (Annals of Surg., Aug., '96).

Case of boy run over by heavy wagon,

resulting in fracture of right lower ribs; symptoms of internal hæmorrhage pointed to right kidney. When abdomen was opened, spleen had been completely severed from remainder of organ and forced to right side of abdomen. Right kidney was so badly crushed that it had to be removed. Remnant of spleen removed. Boy died in twenty-four hours. At autopsy it was found that left kidney had been torn completely through. Robert Abbe (Med. Record, Apr. 23, '98).

Injuries to the ureter in addition to the general symptoms of shock, which may subside within a few hours, are characterized by the appearance of little blood in the urine and perhaps only an occasional clot. If no lesion of an abdominal organ accompanies rupture of the ureter, no very great symptoms will be manifested. Transient hæmaturia should not be overlooked, especially with persistent pain in the side. C. L. Scudder (Boston Med. and Surg. Jour., May 2, 1901).

Prognosis. — Death almost invariably attended rupture of the intestinal tract prior to the introduction of exploratory abdominal section, and prompt resort to active surgical procedues, when necessary, is indicated.

Chavasse has collected thirty-six cases of kicks in the abdomen by horses, thirty-five of which died. A man who has been kicked in the abdomen by a horse has one chance out of three of dying. More than one-half of personal cases saved, thanks to intervention, although it is true that some cases were opened which might have recovered spontaneously. The laparotomy did no harm. Intervention should be practiced when there are sharp, local pains and rapid elevation of temperature. Kirmisson (La France Méd., No. 14, '95).

Three hundred and seven cases of contusions of the abdomen, from the kick of a horse, treated without operation, found in literature; 215 recovered and 92 died. Of 36 cases in which operation was practiced, 26 died and 12 recovered, and in only 3 of these could operation have been considered as imperatively necessary. As soon as a patient is kicked in the abdomen by a horse, he should be taken to a hospital, a careful history of the accident taken down, and the patient treated expectantly. He should be placed in bed, heat applied, pain relieved, and should be given no food; every half-hour the temperature and respiration should be recorded, with a note of the general condition and the local symptoms. The moment that peritoneal reaction or general infection is evident the abdomen should be opened. Seven cases personally witnessed in which recovery occurred without operation. Nimier (Arch. de Méd. et de Pharm. Mil., Mar., '98).

Where abdominal contents are ruptured 96 per cent. of cases die. Early operation favored. John T. Rogers (Jour. Amer. Med. Assoc., July 9, '98).

As to the liver, as late as 1864 wounds of this organ were considered as practically hopeless in every instance. While a very small proportion of these cases recover without surgical interference, as is shown by the scars occasionally found in the hepatic parenchyma, the fact remains that an exploratory laparotomy, permitting the surgeon to quickly arrest the loss of blood in case of hæmorrhage and to rid the peritoneal cavity of accumulated extraneous fluids, has greatly reduced the mortality. The prognosis becomes much more unfavorable when peritonitis has set in, but a fatal issue may sometimes be averted, even in advanced cases of this complication, by surgical intervention.

Case in a girl, aged 9, who, four days after receiving a kick, came under treatment, with well-marked peritonitis. On the fifty-second day abdominal section; adhesions found everywhere. Nevertheless almost steady recovery. A year afterward the child seen and in perfect health. Greiffenhagen (St. Petersburg med. Woch., Apr. 25, '92).

The same remarks apply to rupture of the gall-bladder.

Case of rupture of the gall-bladder due to a blow upon the abdomen. Three weeks after the accident laparotomy was performed with the removal of three quarts of brownish fluid containing numerous blood-clots. Convalescence slow, but complete. Thomas (Deutsche med. Woch., July 14, '92).

Slight contusions of spleen heal readily, but rents and tears of any importance are frequently followed by fatal hæmorrhage. Abscesses occasionally complicate convalescence.

Case of V-para of 31 in sixth month of pregnancy. Drunken man had trodden on the left side of her abdomen; on following day there were signs of internal hæmorrhage. Laparotomy disclosed rupture of spleen as source of bleeding. Spleen extirpated and the woman made excellent recovery and was spontaneously delivered of a healthy child at full term. Tabulated eight reported cases of removal of spleen for injury, five recoveries. Savor (Centralb. f. Gyn., 1305, '98).

The great majority of cases of rupture of the kidney that recover are those in which the initial lesion had been comparatively slight. In the graver cases, in which there is copious hæmorrhage into the perinephric tissues or into the peritoneal cavity, of which the growing exsanguinity of the patient is an indication, the prognosis depends upon the speed with which adequate surgical procedures are instituted. Occasionally, however, the blood is held in check by the renal capsule.

The prognosis depends greatly, therefore, upon the patient's ability to stand operative procedures suitable to establish a positive diagnosis and bring the lesion that may at any moment destroy life within the immediate reach of art's highest powers. When serious injury is rendered probable by the nature of the accident, and the symptoms present also indicate a serious lesion, an exploratory incision, if the patient is not past relief, a careful examination of the organs involved, arrest of hæmorrhage, closure of the disrupted tissues, or cleansing of the abdominal cavity may save him even when his condition appears almost hopeless.

Again, the prognosis is influenced by the time elapsing between the accident and the institution of surgical procedures. The sooner they are resorted to, all things considered, the greater the chances of success.

No case can be considered as hopeless unless a subnormal temperature, cold and cyanosed extremities, and other signs indicate that the end is near.

A case may be considered as inoperable when there is profound collapse, the tongue being cold, the extremities cyanosed with an imperceptible pulse, and a temperature ranging from 96° to 97° F. Editorial (La Méd. Mod., Feb. 15, '96).

A case of penetrating gunshot wound of the abdomen in which, nearly ten weeks afterward, the bullet, weighing 20 grammes, was extracted. The intestines were not opened, the entire fistulous tract being dissected out. He recovered in six weeks. The bullet had a steel casing, and its deformity showed that it had already struck once and had then been deflected. Calcareous particles and bits of clothing were found in the abdominal fistula. M. Hassler (Jour. de Méd. de Bordeaux, Feb. 3, 1901).

Even when performed late in the history of the case, the operative measures sometimes prove successful.

Case in which blow on abdomen caused rupture of pancreas followed by rapid formation of larger pancreatic cyst simulating closely an abdominal aneurism. Four week's after injury cyst evacuated through the abdominal incision and drained. Critical condition of patient contra-indicated attempt to suture wound in pancreas. On third day following operation subphrenic abscess was evacuated through a bronchus and patient rapidly recovered. There was pro-

fuse discharge of pancreatic fluid from abdominal wound. The cyst contracted to small sinus, which healed on seventy-seventh day after operation. Patient fifteen months after injury was well and showed no functional disturbance of any alimentary process. H. W. Cushing (Jour. Amer. Med. Assoc., Mar. 7, '98).

The early recognition of a rupture of the bladder greatly influences the prognosis. About 60 per cent. of the most unpromising lesion, intraperitoneal laceration, are saved by prompt surgical measures. The remaining 40 per cent. are unsuccessful mainly on account of delay in resorting to abdominal section. A successful result has, nevertheless, followed laparotomy as much as fifty-four hours after the rupture.

Reviews of the literature of 32 cases collected, 22 of which are intra- and 10 extra- peritoneal. Of the intraperitoneal cases 10 recovered. Of the extraperitoneal ones 7 recovered. Schlanger (Archiv f. klin. Chir., B. 43, '92).

As a result of surgical intervention, the mortality from traumatic rupture of the bladder has, during the past fifteen years, been reduced from 90 to about 54 per cent. Of 18 cases of extraperitoneal rupture treated by operation, 10 ended in recovery and 8 in death. Of 34 patients in whom the peritoneal covering of the bladder had been involved in the injury, 14 recovered after operation and 20 died. Sieur (Archives Gén. de Méd., Feb., Mar., '94).

Treatment.—Shock.—Shock or collapse, though unreliable as a sign of severe injury to the abdominal viscera, is, nevertheless, an alarming condition, especially if the temperature is subnormal and the breath is shallow, and it should at once receive attention. The patient is placed in bed with the head low, and a free supply of pure air insured, supplemented with oxygen if practicable. Hot-water bottles are placed around him and he is covered with blankets previously warmed, if possible, or wrung out of hot water.

Two main elements have to be borne in mind in this class of cases: (1) that the state of shock is due to a direct commotion of the sympathetic system with probable inhibition of the heart's action, and (2) the possibility of an internal lesion which may involve death by exsanguination or the outpour into the peritoneal cavity of gastric or intestinal fluids. While the first condition calls for stimulants adapted to sustain the flagging heart and restore the action of the vasomotor, the agents employed should not be administered by the mouth, since, in case of rupture of the stomach, the duodenum, or jejunum, a portion, at least, of the fluid may be added to those that may have found their way into the peritoneal cavity. Rectal and subcutaneous injections should, therefore, be resorted to.

If no remedy be at hand, subcutaneous injections of 1 drachm of whisky or brandy may be employed, and repeated every five or six minutes until reaction occurs. A turpentine stupe or a fresh mustard poultice (not plaster) over the xiphoid cartilage, and a rectal injection composed of a tablespoonful of turpentine, a raw egg, and a teacupful of warm water, sometimes act with surprising rapidity. Hypodermic injections of ether, or, better still, tincture of digitalis with $^1/_{120}$ grain of atropine, repeated in fifteen minutes, are necessary to sustain cardiac action. After the second dose the digitalis may be injected alone several times more. These measures are greatly assisted by galvanic stimulation of the phrenic nerve, the negative pole, moistened in a solution of chloride of ammonium, being applied to the neck in the depression immediately in front of the sterno-mas-

toid muscle, and the positive over the epigastrium.

These means are sometimes inefficient and hypodermoclysis should be performed. If a fatal issue seems inevitable, saline transfusion is indicated.

> When the case is not very urgent, and the operator can act with deliberation, hypodermoclysis should be performed. When the symptoms are alarming and life is about to ebb, saline transfusion is indicated. T. L. Rhoads (Ther. Gaz., Oct. 15, '97).
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> Administration of morphine indicated in cases of great shock after injury. Use of drug should not be continued, one or two hypodermics usually being sufficient. McBurney (Med. Record, Apr. 23, '98).

Reaction. — As soon as reaction occurs in these cases another danger threatens the patient, that of hæmorrhage, which the state of collapse has so far prevented to a degree, unless an extensive injury have caused overwhelming exsanguination. In this event, however, the patient's recovery from the preliminary shock would hardly have taken place. Hence the necessity of closely watching the sufferer.

> After a severe abdominal injury the patient passes through a stage of collapse, through a stage when the diagnosis remains uncertain, through a period when the signs of hæmorrhage show themselves, and through a period of slow complications. Van Verts (Arch. Gén. de Méd., Jan., '97).

Cases of prolonged collapse sometimes turn out to be trivial, while a short period of it may be the prelude to the most grave complications. The former cases are, unfortunately, rare, and profound shock of any duration should be looked upon with suspicion. This is especially the case when a second period of shock is passed through—the "relapsing collapse" of Bryant—indicative of a secondary hæmorrhage or the giving way or separation of some damaged tissues.

That cases, clearly showing by their history and the active symptoms a grave injury, should be submitted to surgical measures as early as possible will hardly be gainsaid in the light of our present knowledge. An equally positive conclusion, based on every means of diagnosis available, will alone warrant the assertion that no serious injury is present; but if, on the other hand, doubt exists, abdominal section will alone insure the patient adequate protection. If nothing be found, no harm will have been done if precepts governing aseptic surgery have been closely followed; if a rent in the liver, an intestinal tear or rupture, a serious hæmorrhage be discovered and adequately dealt with, the patient will have received the benefit of all our art's resources.

> In abdominal injuries when there is pain without cessation and nausea, it is best to operate. J. B. Murphy (Jour. Amer. Med. Assoc., July 9, '98).

The seat of rupture being located, the nature of the injury will determine the procedure to follow, linear enterorrhaphy being indicated in longitudinal ruptures, and circular enterorrhaphy in complete ruptures, a Murphy button being employed. These procedures are now generally preferred to an artificial anus. It is sometimes impossible to adequately adjust the edges of the wound, owing to the condition of the margin, and an omental graft must be used to cover the contused area so as to avoid a secondary perforation.

Considerable extravasation of fæces, blood, and other liquid or semiliquid material may have occurred into the peritoneal cavity. All chances for further contamination of the intestinal tract having thus been removed by closure of

the rupture, the peritoneal cavity should be carefully cleansed by flushing with warm, sterilized water, a soft aseptic sponge being employed to gently mop all the surfaces that may, in any way, have come in contact with the infectious fluids. The cavity is then closed and free drainage insured.

Satisfactory results are obtained even in cases in which very great injury and ample opportunity for infection of all wounds have markedly compromised the issue.

The after-treatment should be based upon the necessity of insuring rest for the intestinal tract for a few days. This may be carried out by administering opiates. The patient's strength should be sustained, however, by means of nutrient, but small and frequently administered, enemata.

Under all circumstances, an abdominal injury should cause the patient to be watched several days. After an uncomplicated injury he should remain in bed and be placed on a milk diet for a few days. Anodyne applications over the abdomen and a little morphine, internally, if there is pain, is all that is usually required in these cases. In the less fortunate the procedure to be adapted varies according to the organ involved.

Intestines.—The probability of a rupture having been recognized, the abdomen should be opened by an incision through the linea alba, and any hæmorrhage quickly arrested. The next step is to locate the visceral injury. Of importance in this connection is the fact that in the majority of cases the rupture is due to compression against the spinal column. The spot over the abdomen upon which the blow carried being considered as the one end of an imaginary line and the centre of the vertebral column as the other end, the probabilities are that the rupture will be found near the linear axis.

> In dogs with intestinal perforation there is constriction of the intestine above and below the point of injury, and swelling of the intestinal loop at the point of lesion. Lesions are always superposed in the direction of the spine; so that by going from injured portion of wall toward the spine the wounded loops are always found. Février and Adam (Revue Int. de Méd. et de Chir., Oct. 25, '94).
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> Any injury to the abdomen, though no external injury occur, may be associated with damage to the intestine or other viscera. An exploratory operation is justifiable in cases with distinct rigidity. An operation is absolutely indicated when there is, besides rigidity, pain, tenderness, vomiting, shock, dullness, or other symptoms indicative of some intra-abdominal disturbance. Cases not operated upon are lost. The importance of early operation cannot be emphasized too strongly. At present the death-rate is about 75 to 80 per cent. Flint (Med. Record, Feb. 18, 1905).

Again, if the rupture cannot be readily found, hydrogen may be insufflated into the rectum, as advised by Senn, and the spot from which the gas escapes will indicate the location of the rupture,—approximately, in the case of the small intestine, and accurately below the ileo-cæcal valve.

Disorders, or lesions other than those sought after, are misleading conditions that should be borne in mind.

Lesions of the jejunum are sometimes difficult to locate.

> Rupture of the jejunum. The patient was struck by the back rail of a barrow, across the upper part of the abdomen; severe pain, but not fainting. He was able to push the barrow a little further and to walk about a mile. No wound nor any bruising evident over the abdomen; very little tenderness, and breathing not markedly thoracic. Temperature, 97° F.; pulse, 80 and weak. On the day following peritonitis present,

and laparotomy performed by Mr. Cheyne. At the upper part of the cavity, behind the liver and stomach, the peritonitis was most acute, and a rent was found in the upper end of the jejunum. Patient returned to bed very much collapsed and died nine hours after the operation. C. J. Hood (Brit. Med. Jour., Apr. 5, '90).

Rigidity of the abdominal muscles, attended with dullness, even slight in degree, and local tenderness, are most valuable points in the diagnosis of these injuries, and where they exist, and especially if a blood-count shows an active leucocytosis, operation is demanded and no time should be lost in performing it. It is very hard to convince the patient and his friends of the actual condition, and they will invariably plead for delay. The serious condition should be early pointed out, and every effort made to secure consent to operate while the condition of the patient renders success probable.

These cases are almost inevitably fatal without operation, and the effect of an exploratory incision while the patient is in a fair condition is not serious enough to counterbalance the advantages to be gained if rupture of any of the organs is found to exist. W. G. Weaver (Pennsylvania Med. Jour., July, 1904).

Stomach. — When the symptoms of complete tear are recognized, the presence of the organ's contents in the abdominal cavity render an immediate laparotomy imperative. The incision should include the tissues between the xiphoid cartilage and the umbilicus. If the tear cannot be quickly found, repetition of the inflation with hydrogen-gas will help to locate it. As soon as located any bleeding vessel should be ligated, and the stomach evacuated and cleansed through the adventitious opening of any substance that may have remained in it. If the wound be a lacerated one, it may be necessary to pare its edges. This being done, the tear is closed, the mucous membrane being united with a continuous or interrupted suture, cut short, and the muscular and serous coats by the continuous Lembert suture. Closure of the laceration having removed all danger of further extravasation into the peritoneal cavity, the latter must be flushed with warm, sterilized water and mopped out with a soft sponge. The cavity is then closed and a drain left if the peritoneal surfaces have been exposed to contamination for some time.

Experiments in cats in which large openings in the stomach were successfully closed by means of an omental plug. The surrounding mucous membrane always prolapsed freely and the piece of omentum, already fixed to the serous coat close to the seat of excision, was sewn around the wound, the omental tissue being fixed to the serosa. A process of omentum was then sewn over the whole, this being necessary in the case of cats, owing to the thinness of the omentum. The transplantation not only succeeded, but the omental tissue gradually assumed the character of gastric mucous membrane. Well-formed glands developed. Enderlen (Deut. Zeit. f. Chir., Apr., 1900).

Liver.—Especially when the history of the case seems to indicate the possibility of a lesion of this organ is careful watching imperatively demanded, owing to the violent hæmorrhages which they involve. Either this complication or peritonitis having been recognized, the abdomen should be opened at once in the middle line. The abdominal wound should be large enough, if possible, for the surgeon to see the liver, but in every case he ought to make a careful exploration with his finger, especially directing his attention to the convex and posterior surfaces of the organ.

When a rupture is found, the wound may either be cauterized, plugged, or sutured.

Where the wound is a large one the combination of sutures, mattress-sutures, and tamponade may be necessary; but, as a rule, the tampon should be used only in cases where sutures have failed to check the hæmorrhage. Of the three methods the thermocautery is of least value; it will check only moderate parenchymatous hæmorrhage, is of no value in extensive wounds, and is apt to be followed by secondary hæmorrhage. Schlatter (Annals of Surg., Apr., '97).

A jet of steam to control hæmorrhage from the contused liver or omentum, first recommended by Sneguireff, has antiseptic as well as hæmostatic virtues. When the tampon is employed, the surrounding peritoneal cavity should be shut off by a few sutures. Doyen (Le Progrès Méd., Oct. 30, '97).

Plugging with antiseptic or aseptic gauze seems to give the best results, one end of the gauze being left out at the angle of the abdominal wound. The plug should be removed not earlier than the forty-eighth hour, lest there should be a recurrence of the hæmorrhage, and not later than the fourth day, lest a biliary fistula should be formed. When the bleeding is very severe sponges mounted on holders appear to produce more satisfactory pressure than simple plugging, which is, perhaps, better reserved for slighter injuries. Hot-water irrigation may be of advantage in these cases. A ligature should be applied to any large vessel which is seen to have been torn. Sutures are particularly useful when the laceration extends deeply into the substance of the liver, since by their means the edges of the wound may be brought lightly together and the bleeding can be controlled. Drainage of the pelvic pouch, by an opening just above the pubis, serves best to give free passage to subsequent discharges. The capsule should be included in the stitches. The prognosis is very unfavorable when peritonitis has occurred, but something may still be done to prevent the fatal issue by opening and afterward draining the abdominal cavity.

Two cases of rupture of the right lobe in a woman of 21 years struck by a train. Rent found in the under surface of the liver, 2 1/2 inches long, and 1 1/2 inches deep; also several small rents in the spleen. Wound closed. Rapid recovery. Case of a man, 44 years old, caught between two cars. Rent in the under surface of the liver. Hæmorrhage checked by pressure with gauze; abdominal wound closed. Rapid and good recovery. Delatour (Med. News, Feb. 17, 1900).

Ruptured liver in a man of 25 upon whom a case of glass, weighing half a ton, fell. Collapse, pain, and tenderness in the upper part of the abdomen, and increased liver-dullness. Almost pulseless within three and one-half hours. Intravenous injection of saline solution given, and the abdomen opened. Found full of blood, and across the under surface of the liver was a laceration extending from the gall-bladder to the posterior part. The laceration was packed with iodoform gauze, and the wound was approximated. The patient remained pulseless nearly thirty hours, but gradually recovered. Thomas Carwardine (Lancet, May 12, 1900).

Spleen.—After a simple contusion the spleen soon returns to its normal condition without further trouble, and a few days in bed, coupled with strapping of the side to limit motion, usually suffice. When, however, there is laceration of the parenchyma the convalescence is slow, abscesses following in quick succession. After a time these cease and recovery is uninterrupted. Symptomatic treatment, revulsion over the organ, and tonics may shorten the duration of such cases.

When the symptoms do indicate that exsanguination of the patient is taking place, death will most probably follow, although the hæmorrhage is not as copious as it can be in tears of the liver, the

splenic capsule being more elastic than that of the latter organ. Removal of the organ should be resorted to. The abdominal wall is opened by means of an incision through the left semilunar line and the peritoneum is freely opened. The hand being introduced into the cavity, all adhesions are torn up and the organ is brought to view. The vessels entering the hilum are then clamped and the organ is removed. The stump is ligated and, after sponging out the abdominal cavity, the wound is closed.

Results of splenectomy for rupture. Study of seven cases suggests following conclusions: 1. A marked leucocytosis follows removal of the spleen. It follows immediately after removal, and continues gradually to decline; lasts six months or more. 2. The various forms of leucocytes are increased in number in various proportions, and do not bear the same ratio to each other as in normal blood. 3. The anæmia produced by the accident is very slowly recovered from after the removal of the spleen. 4. In a certain number of cases (three out of seven) the removal of the organ is followed at an interval of from ten days to three weeks by a train of symptoms characterized by pyrexia, wasting, extreme weakness, anæmia, frequent pulse, pallor, thirst, and headache, which last for a varying period and are slowly recovered from. 5. The external lymphatic glands undergo enlargement and in some cases a marked hypertrophy. George Heaton (Brit. Med. Jour., Aug. 19, '99).

Kidney.—The majority of mild cases of perirenal extravasations of blood and urine recover as the result of rest and expectant treatment. The patient should be kept in bed and his diet limited to liquids, the best of which is milk; this beverage requires, besides, the least physiological labor from the injured organ. The nourishment of the patient may further be sustained by rectal injections of beef-tea, and these should entirely be resorted to if there is vomiting, the latter tending greatly to encourage hæmorrhage. When the latter occurs in the direction of the bladder, there is likely to be accumulation of blood-clots, which, if small, will readily pass out with the urine. Frequently, however, the clots are large and cause retention of urine and marked tenesmus. A large catheter should therefore be introduced and kept *in situ* when the hæmaturia is marked, and the bladder occasionally washed out with a weak boric-acid solution. Median urethrotomy to remove clots and relieve retention sometimes becomes necessary in these cases. When the symptoms do not improve under these measures, an incision should be made, exposing the seat of injury, the extravasation removed, and the parts restored, by appropriate measures, to their normal conformation.

There is great danger in delaying operation in these cases; the decomposition of the clots and the cystitis which is excited by their presence, as well as the frequent catheterization needed, expose the patient to all the dangers of suppuration of the wounded kidney, and also to the risk of infection. Henry Morris (Clin. Jour., Aug. 1, '94).

The dangers of rupture of the kidney are mainly hæmorrhage and sepsis. When, therefore, the symptoms are such as to indicate marked hæmorrhage or sepsis, and especially if a tumor form quickly in the lumbar region, an exploratory operation should at once be done. If severe laceration be present, or the kidney's functions be practically compromised, or the hæmorrhage be such as to require ligation of the renal vessels, lumbar nephrectomy should immediately be performed, primary nephrectomy being safer than secondary removal of the organ.

Eleven cases of kidney traumatisms, with eight recoveries and three deaths,

expectant treatment having been employed. Wagner (Deutsche Zeit. f. Chir., B. 34, p. 98, '93).

Five cases of primary nephrectomy with one death, a mortality of 20 per cent.; and thirteen cases of secondary nephrectomy with five deaths, a mortality of 38.5 per cent., showing that secondary nephrectomy is nearly twice as fatal as primary.

As to the route of the operation; of three cases of abdominal nephrectomy, one died, a mortality of 33.3 per cent.; and fourteen of lumbar nephrectomy, of which four died, a mortality of 28.6 per cent. W. W. Keen (Annals of Surg., Aug., '96).

Bladder. — When a patient presents the history of a severe abdominal contusion or crushing, followed by inability to micturate, the catheter should at once be used.

Most important signs of vesical rupture: a peculiar pain felt at the time of the injury; chilling of the surface of the body, which persists for some time: an urgent desire to micturate, which the patient cannot satisfy; the absence of any vesical swelling above and behind the pubes, and also the absence or the presence, but in very small quantity, of urine in the bladder. Catheterizing, though valuable, ought not to be practiced except with very great caution. Sieur (Arch. Gén. de Méd., Feb., Mar., '94).

The presence of hæmaturia will indicate a lesion in the urinary tract, kidney, or bladder. If the urine withdrawn is observed to be well mixed with blood and, instead of red, it appear brown and smoky, the lesion is probably one of the kidney. If, on the contrary, the urine be bright red, the probability is that the bladder has been torn. In the latter condition the diagnosis may also be assisted by the quantity of fluid passed at a given time. If, when the catheter is introduced and after a history marked with shock, no urine is obtained, the chances are that not only the bladder has been ruptured, but that the laceration is extensive, the opening having allowed the vesical fluids to escape into the abdominal cavity. A free flow, on the contrary, would tend to show that the tear, if any exist, is small. Of course, the invagination of the intestines into the vesical opening, or a valve-shaped laceration, may cause the same favorable signs to exist, thus misleading the diagnostician. Very small lesions may be present, sufficient to allow the urine to escape, drop by drop, into the surrounding parts. Detection of them is very difficult, the subsequent complications alone showing the presence of extravasated fluids.

The presence of any tear, except very small ones, may also be ascertained by injecting a weak boric-acid solution into the organ, through the catheter. If a rupture be present, the bladder will not fill and rise above the pubis. Filtered air may be used for the same purpose, but it is less satisfactory, owing to the danger of secondary collapse.

Case in which diagnosis was established by inflating the bladder with air forced in by two or three compressions of the rubber ball of an ether-freezing microtome. The amount of air to be introduced need only be very small, and only moderate pressure is required for the inflation.

The introduction of air through the rent into the abdominal cavity, even in small quantity, was attended by a profound disturbance in the patient's general condition, which passed off on opening the abdomen and allowing the free air to escape. The method should not be applied till the patient is on the operating-table, so that, should the collapse threaten life, the abdomen could be opened at once. W. J. Walsham (Univ. Med. Jour., July, '95).

The urine may have passed into the prevesical connective tissue outside the

peritoneum, or the vesico-rectal or vesico-uterine space, owing to a rupture in these locations. This constitutes the extraperitoneal lesion. Cellulitis and sloughing rapidly ensue without subsequent involvement of any organ in the neighborhood of the lesion, the vagina, the rectum, etc., the patient dying from septicæmia.

> Two cases of uncomplicated intraperitoneal rupture of the bladder. Death probably due to the absorption of the urine by the peritoneum and to its continuous accumulation in the blood. In both cases the rupture was situated on the posterior wall. There were no signs of acute peritonitis in either case. The patients lived probably five and three days, respectively, after the accident. Joseph Coats (Brit. Med. Jour., July 21, '94).

To ascertain whether a tear be extraperitoneal or not, a measured quantity of a weak boric-acid solution is injected through the catheter. If the full amount is not recovered, the chances are that the rupture is extraperitoneal.

> In investigating a suspected case of rupture the greatest care should be taken to keep the bladder aseptic; so that, in case there is a rent, germs cannot spread into the tissues, and especially into the peritoneal cavity. In making the test also of injecting fluids in measured amounts, and then observing whether the same amount is voided, care should be taken not to distend the bladder more than very moderately, lest a partial rupture be converted into a complete one. H. Aue (Deutsche Zeit. f. Chir., p. 351, '92).

Rupture into the peritoneal cavity, the intraperitoneal form of lesion, is less urgent as far as symptoms go. One, and even two, days may elapse before active symptoms appear; but, when they do, rapid progress toward a fatal issue from general peritonitis is the rule.

Uncomplicated contusion of the bladder readily yields to a few days' rest, the application of ice, and general symptomatic treatment. When, however, there is cause for suspecting a rupture from the nature of the accident or the violence of the blow, the catheter should at once be introduced. The presence of blood renders operative interference imperative. After the rectum has been distended with a rectal bag an incision three inches long is made in the middle line of the hypogastrium, beginning half an inch below the upper edge of the pubes, as in suprapubic lithotomy.

> It is best to first open the prevesical space, when it can be determined whether the rupture is extraperitoneal, and, if so, the necessary treatment to be carried out. If the rupture is found intraperitoneal, the abdominal incision is carried upward and the peritoneal cavity is opened, when the rent is located and properly disposed of. John B. Deaver (Univ. Med. Mag., July, '96).

The peritoneum is then carefully rolled up, along with the prevesical fat. The bladder being thus exposed, search for the rupture is the next step. The rent is usually found along the posterior surface vertically down from the urachus; frequently an extravasation of blood and urine indicates the spot. Occasionally, however, considerable difficulty is experienced, and opening of the organ is necessary so as to permit the introduction of the finger, and thus allow of exploration of its inner surface.

The rupture may be extraperitoneal or intraperitoneal. If an intraperitoneal laceration is found, the incision should be extended upward, the peritoneal cavity opened, and the cystic wound closed with fine silk by means of Lembert sutures, one-eighth of an inch apart, including only the peritoneal and muscular coats. The mucous membrane of the bladder should be respected. Important, in this connection, is the neces-

sity of ascertaining that the sutures will hold; this may be done by distending the bladder with a lukewarm milk or an alkaline solution.

> Of the 28 cases recorded by various operators, 11 recovered and 17 died. Of the 11 that recovered, in only 1 was peritonitis present at the time of operation, while, conversely, of the 17 that died, in 8, and probably in 9, peritonitis had already set in. The causes of death in the 8 cases in which there was no peritonitis at the time of operation were: in 5, shock or hæmorrhage or the two combined, and in 3 peritonitis, the peritonitis in 2 out of the 3 being due to leakage of the rent or giving way of a suture. In no fewer than 4 out of the 28 cases was the bladder found, at the post-mortem examination, to leak. The importance of testing the competency of the bladder by injecting milk or other bland and easily detectable fluid could not, therefore, be too strongly urged. W. J. Walsham (Univ. Med. Jour., July, '95).

The abdominal cavity is then carefully irrigated and closed, leaving a drain if there is any possibility that fluids will accumulate in any of the surrounding tissues.

Wounds.

Wounds of the abdomen may be *non-penetrating*, when the abdominal walls alone are injured, and *penetrating*, when the peritoneum is included in the lesion, irrespective of the instrument (pistol, knife, etc.) with which the lesion is produced.

Non-penetrating Wounds.

Non-penetrating wounds are usually due to pointed cutting or blunt instruments.

The lesions caused by a pointed instrument, involving the skin and muscles only, are usually very slight. With due aseptic precautions careful exploration of the wound with the finger may be resorted to if the visceral examination do not suffice. Probes had better not be used, lest the wound be transformed into a penetrating one.

Lesions caused by cutting instruments (knives, swords, etc.) vary in importance according to their depth and length. When the muscles are cut, the support for the abdominal organs is compromised, and ventral hernia may follow, unless great care be taken when the wound is closed.

Lesions caused by blunt bodies (such as shot, glancing bullets, and fragments of shells, etc.) are usually attended by symptoms of contusions corresponding in intensity with the force of the blow. Severe laceration of the abdominal tissues may thus be caused and death occur from intestinal lesions.

The hæmorrhage attending these various kinds of wounds is usually slight. There is considerable ecchymosis, but this soon disappears. Occasionally shots or bullets become imbedded in the abdominal tissues.

Treatment.—After carefully arresting bleeding, cleansing, and disinfecting the wound, the tissues are united. In deep incised wounds the prevention of ventral hernia should be borne in mind, and the cut muscular tissues brought accurately together by means of catgut sutures. This being done, silk sutures are also introduced and brought out to the surface, thus including the muscles and skin. Capillary drains are alone to be used, if drainage is at all necessary, larger drains affording opportunity for the formation of a ventral hernia. The abdomen should be supported by means of a bandage applied over the dressing and the patient kept in bed until complete repair of the wound has taken place; from two to five weeks, as a rule. The bandage should be carried long after recovery, and the patient be warned of

the danger he might incur by violent movement or strain.

Penetrating Wounds.

The softness of the tissues of the abdominal parietes causes them to be easily penetrated, and the organs within the cavity are all vulnerable for the same reason. The interstices between them occasionally allow the harmless passage of a weapon or bullet, but such cases are extremely rare, only nine such cases having been recorded during the Rebellion.

The missile may graze the peritoneum and barely miss it along with the deeper organs. Unfortunately wounds causing laceration of one or more of the abdominal viscera are the most frequent, and their fatality is proverbial unless a timely diagnosis allow of prompt protective measures.

As is the case in contusions, the direction from which the missile or stab comes is of great importance. A bullet arriving from the side and striking near the linea alba would probably create a button-hole wound or bury itself in the abdominal walls. A bullet coming from the front, on the contrary, would most probably perforate the organs in its axial line of flight. If the bullet has passed through the body an imaginary line between the entrance and exit will probably indicate the organs injured, including, of course, the peritoneum. Here again, however, the spinal column may cause deviation when the initial velocity of the bullet is small, and a deceptive line of injury furnished. To positively determine the course of a bullet is difficult in many cases.

In stab wounds the opening is frequently of a sufficient size to permit prolapse of the omentum: an evident proof that the abdominal cavity has been penetrated. This rarely occurs in bullet wounds unless a large projectile, or a bullet coming from either side of victim, have caused comparatively large solution of continuity of the tissues. Prolapse of the omentum is most frequently observed in lesions of the left side. Coils of the small intestines are also frequently prolapsed and, in rare cases, the stomach, the liver, or the spleen have appeared between the lips of the wound.

Symptoms.—As is the case after contusion, penetrating wounds of the abdomen may give rise to no symptoms capable of affording any reliable clue to the extent of the internal injuries. Profound shock may be present and no serious lesion exist.

> Case of a man brought into one of the surgical wards with an external wound. He was lifted to bed absolutely helpless and a serious gunshot wound of the abdomen suspected from gravity of symptoms. The bullet found in the leg of his drawers. The patient was unable to get out of bed for hours. A. B. Miles (Southern Surg. and Gynec. Trans., vol. vi, p. 183, '94).

Severely injured individuals may, on the contrary, present no acute symptoms and, perhaps, walk or ride a considerable distance before showing noticeable evidence of their condition.

Profuse hæmorrhage alone gives rise to symptoms denoting a grave lesion: rapidly progressive exsanguination or acute anæmia; nausea or vomiting; weak, rapid, and sometimes irregular pulse; dilated pupils; cold sweats; yawning, ending in convulsions and coma. Shock is likely to be progressive in these cases.

> Fatal cases of marked laceration of liver and bowel in which there was neither shock, hæmorrhage, nor high pulse. W. L. Robinson (Jour. Amer. Med. Assoc., Dec. 15, '94).
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> If the shock is progressive it means internal hæmorrhage. When a patient is first seen he may be profoundly

shocked and not be much disturbed, but, if he continues to become more shocked, it means hæmorrhage. Shock at the time of injury does not mean hæmorrhage, but later on it does. L. McLane Tiffany (Pacific Record of Med. and Surg., Feb. 15, '96).

Two cases of stab wounds in the abdomen. In one of these there was no doubt as to the fact that the wound penetrated the intestines, as the latter were extruding from the incision. While the probabilities against a penetration of a stab wound into the intestines or stomach are 70 per cent., yet we have no means in many cases of telling from the first whether penetration has taken place, and therefore immediate laparotomy should be performed in all cases of stab wounds of the abdomen, without waiting for symptoms of perforation to appear. B. K. Finkelstein (Praktitcheski Vratch, May 24, 1903).

The only symptoms that are present in practically all cases are pallor and vomiting: the accompaniments of any severe blow on the abdomen, and therefore of no value whatever as differential signs. The temperature is of no assistance in these cases.

Diagnosis. — On general principles dangerous complications are to be expected when marked shock, nausea, vomiting, hiccough, anxiety, intense thirst (indicating a probable involvement of the peritoneum), and insomnia are present. Besides these indications there are others peculiar to each organ which greatly assist in establishing at least an approximately certain diagnosis.

The absence of liver-dullness is of less significance than is usually believed, but the disappearance of liver-dullness is of more value. The most important symptoms in personal cases were tension of the abdominal muscles, local meteorisms, and dullness in the region of the wound. The general symptoms were those of peritonitis. Petersen (Münchener med. Woch., Apr. 9, 1901).

Intestines.—According to Senn, bullets striking the abdomen antero-posteriorly rarely cause more than four perforations, while oblique or transverse shots are likely to produce a much larger number of lesions: from fourteen to sixteen. On general principles, however, a penetrating wound may always be considered as having caused a lesion of the intestines.

The most important symptom is the escape of intestinal gases and more or less fluid substances through the wound. The mere presence of emphysema around the wound is of no value, however, since air is generally forced into the wound by the bullet.

Case in which the absence of intestinal perforation was established by ether inflation of the intestines. The bowels were inflated with ether, which escaped from the mouth. The peritoneal cavity was opened, and the ball was found to have passed above the liver, injuring the diaphragm, and burying itself in the tissues behind. The blood-clots were removed and the abdomen closed. The inflation of the intestines caused a sense of fullness, but no other discomfort. The patient made an uneventful recovery. E. M. Sutton (Jour. Amer. Med. Assoc., Dec. 30, '99).

Free hæmorrhage from the wound tends to indicate an intestinal lesion; if the stools also contain blood the diagnosis may be considered as certain.

In penetrating wounds of the abdomen there are absolutely no known symptoms which indicate injury to any of the viscera, except those noted in connection with the urinary tract, stomach, and occasionally the lower bowel. Except those relating to general shock, all symptoms following such wounds indicate either internal hæmorrhage or peritonitis. To wait for symptoms of perforation of the intestine means to wait until peritonitis has developed; therefore every bullet or stab wound which penetrates the abdominal cavity should be operated on at the earliest possible moment in order to anticipate the advent

of peritonitis. No time should be wasted in attempting to demonstrate the presence or absence of intestinal perforation by such means as the rectal insufflation or gases or vapors, or the analysis of recollected intraperitoneally injected air or liquids.

It is essential to systematically examine the entire gastro-intestinal canal in all cases, regardless of the point of entrance of the wounding body. Whenever the alimentary canal has been perforated, suitable drains (the author prefers the so-called cigarette drains) should be placed either through the operative incisions or counter-incisions, as may appear best suited to the individual case. M. L. Harris (Annals of Surg., March, 1904).

Probes have been discarded in penetrating wounds, owing to the irregular course followed by the bullet in many cases and the danger of creating a false passage. Digital exploration of small wounds furnish but little information, while in bullet wounds there is danger of pushing into the peritoneal cavity what foreign substances may happen to be present.

The majority of surgeons now favor enlargement by an incision at least two inches in length, intersecting the bullet or incised wound. Layer after layer of tissue is carefully dissected on each side of the track, the walls of which, in gunshot wounds, are usually darker than the normal tissues, owing to contact with the lead or powder-products of combustion. Using the grooved director to divide the tissues and the hæmostatic forceps to grasp any bleeding vessel, the peritoneum is finally reached, when the certainty that a penetrating wound is present or not may be established. If practiced with strict aseptic precautions, this procedure does not expose the patient.

Study of fifty-six cases showing that proof of penetration through peritoneum should be sought by enlargement and careful investigation of original wound. Penetration having been found, immediate enlargement of the wound should be made. C. L. Scudder (Boston Med. and Surg. Jour., July 25, '95).

Stomach.—Hæmatemesis is a frequent symptom of penetrating wound of this organ and a much more valuable one than in contusion, since, in the latter, a slight laceration of the mucous membrane may produce it. The blood may be pure, but in the majority of instances it is mixed with partially-digested alimentary semiliquid material. If the wound is sufficiently large to allow the contents to escape through it the nature of the injury is, of course, clear, but an important complication is to be apprehended: extravasation into the peritoneal cavity capable of causing peritonitis. If this is circumscribed, adhesions are formed and the patient recovers. Frequently, however, general peritonitis follows, ending in death. Hence the importance of an early recognition of extravasation.

Besides hæmatemesis and the presence of gastric fluids, there are usually present in such injuries the marked symptoms witnessed in cases of contusion: rapidly progressive anæmia, pallor, fluttering pulse, etc.

Liver. — A wound of the liver gives rise to all the symptoms observed when a contusion has caused laceration of the organ. Intermittent pain, radiating in various directions, especially toward the shoulder, if the convex portion of the organ is torn, and in the direction of the waist, if the concave or inferior portion of the organ is the seat of injury. There is marked pallor, superficial itching, and, later on, jaundice. The stools may be clay-colored, thus indicating the absence of bile.

The hæmorrhage varies in these cases according to the cause of the lesion; one

caused by a bullet is prone to be accompanied by considerable and frequently fatal bleeding. Stab wounds, when the weapon is not large, do not give rise to considerable hæmorrhage. A copious flow of blood from a wound in the hepatic region indicates that the liver is involved. The flow of bile through the wound is a valuable sign, but it is seldom that this secretion can be obtained alone, blood being usually mixed with it.

Spleen.—In cases in which the spleen is wounded the diagnosis can easily be established by the location of the external opening and the direction of the track.

Perforating gunshot wound of the kidney. (*M. H. Richardson.*)
(Annals of Surgery.)

As is the case in contusion, there is marked local pain and profuse bleeding, which, if the organ is greatly lacerated, may soon prove fatal. This is apt to occur after gunshot wounds at close range, the organ under such circumstances becoming pulpified. Puncture wounds are less likely to produce fatal hæmorrhage.

Kidneys. — The symptoms frequently accompanying wounds of the abdominal organs, extreme pallor, weak pulse, cold extremities, nausea, and vomiting are apt to be most marked when, besides the organ itself, the peritoneum has been pierced.

A wound of the kidney gives rise to severe pain in the majority of cases, but this symptom may be absent. As in cases of laceration, the pain radiates in various directions, especially in the direction of the external genital organs. The testicle of the corresponding side, besides being the seat of considerable suffering, is frequently raised by spasmodic contractions of the scrotum.

At first a small quantity of bloody urine may be passed, but this is often followed by vesical tenesmus and complete retention, due to the presence of clots in the bladder.

Much information is sometimes obtained by a close examination of the wound of exit. If the track of the bullet be antero-posterior and the missile have entered from the front and penetrated the kidney, the exit wound will be found in the lumbar region. It is frequently found in this situation to contain urine, a positive indication that the organ or its annex, the ureter, has been wounded.

If the wound of entrance be in the back, its location over the site of the kidney may suggest a lesion of the latter; but the urine test will only be of value if the projectile only penetrate the kidney without perforating it. If it penetrate the organ, the extravasation will take place into the peritoneal cavity. The same will be the case if the missile enter from the front without going through the organ. Bullets buried in the renal parenchyma either become encysted or cause abscesses, and pass out through the ureters or into the adjoining parts.

Case of gunshot wound of the kidney made evident by the appearance of urine saturating the dressing in the lumbar region. The amount of urine on the dressing gradually decreased, and after about six weeks the sinus had closed. William F. Barry (Med. Record, Mar. 24, 1900).

Bladder.—The symptoms vary according to the location of the wound. A perforation between the symphysis and the peritoneum above does not give rise to general symptoms; whereas shock, pallor, weak pulse, vomiting, etc., may be much marked when the peritoneum is involved in the injury. In all cases, however, severe pain is experienced at the site of the lesion and radiating to the thighs and testicles.

The passage of urine soon becomes very difficult and spasmodic. It may be voided, drop by drop, for a long while, notwithstanding the efforts of the patient, then suddenly gush out for a few moments and again flow slowly. This symptom may be due to accumulation of clots or to spasm of the urethra. If the catheter is passed, hæmaturia becomes evident when the bladder has been penetrated: a characteristic sign.

As in the case of rupture due to contusion, infiltration may take place through the wound into the neighboring tissues; any obstacle to the free passage of urine greatly encourages this. Hence the necessity, in all bladder lesions, of keeping the organ as free as possible by the frequent use of the catheter.

Prognosis.—The statistics so far published differ so widely that it is difficult to reach a definite conclusion. It is certain, however, that gunshot wounds are more frequently fatal than stab wounds, but that stab wounds, in which the peritoneum is penetrated, are fully as fatal as gunshot wounds.

Intraperitoneal wounds of the bladder are uniformly fatal, while extraperitoneal wounds gave a mortality of only 15 per cent. Gunshot wounds of the kidney are attended with a death-rate of 44 per cent. In gunshot wounds of the liver the mortality is 26.8 per cent. Wounds of the spleen are difficult to diagnose; mortality 65 per cent. Wounds of spinal cord in the lumbar region result fatally. Mortality of wounds of the pelvic bones also very high. Seliger (Präger med. Woch., '92).

Statistics collected by various writers, showing the mortality to range from 65.6 per cent. to 70.67 per cent. Shock is one of the chief causes of these results. Conner (Jour. Amer. Med. Assoc., Sept. 16, '93).

Immediate operation is the best and wisest course to pursue in perforated, punctured, and gunshot wounds of the abdomen. This is the rule which is followed in the University of Munich. Seven gunshot wounds treated with a mortality of 58 per cent., and 22 stab wounds, with a mortality of 18.1 per cent. Series of 30 cases treated by conservative methods between 1876 and 1890, the mortality having been 46.6 per cent. Paul Ziegler (Münch. med. Woch., Mar. 8, '98).

In 253 cases of gunshot injuries of the abdomen the total mortality was about 52 per cent.; in 28 of the 133 fatal cases unsecured perforations or hæmorrhage was found; peritonitis at the operation was found in 11 of the cases that recovered, showing that about 5 per cent. of such cases recover even if this dangerous complication is present. H. H. Grant (Jour. Amer. Med. Assoc., Mar. 17, 1900).

The kind of weapon inflicting the injury plays an important rôle in this connection. A triple-edged bayonet is more likely to produce a serious laceration than a flat blade. Again, wounds caused by small weapons, such as a Flobert rifle, for instance, would hardly produce lesions to be compared to the old Enfield or Minie rifles, which sometimes caused a large portion of an organ to protrude through a wound of exit the size of an apple.

Portions of the solid viscera are sometimes cut off or shot off, leaving a gaping tear, which greatly compromises the issue. Again, as is often the case with the liver, the bullet, or any foreign material dragged in by the latter, may lead

to complications which greatly reduce the chances of recovery.

An important factor is the time elapsing between the receipt of the injury and that at which competent treatment is applied in mild cases. This is especially true as regards the early utilization of surgical measures when these become necessary. The sooner these are instituted, the more favorable the prognosis, especially during the first ten hours.

> Statistics of 154 laparotomies for gunshot wounds: Operation five hours after traumatism; mortality, 52.7 per cent. Operation ten hours after traumatism; mortality, 74 per cent. Operation twenty hours after traumatism; mortality, 73.9 per cent. Operation after twenty hours after traumatism; mortality, 78.2 per cent. Hæmorrhage kills early, if at all. Edouard Adler (Jour. de Méd. et de Chir. Prat., Sept. 25, '92).

Intestines. — The prognosis depends greatly upon the nature of the lesions. Stab wounds opening the intestine lengthwise, if small, often heal of their own accord; transverse wounds are more serious, while complete section of the bowel is a very dangerous complication. Gunshot wounds show a great fatality. Prior to the introduction of antiseptic surgery the mortality exceeded 90 per cent.; since then, the mortality has been decreased to 43 per cent. in cases operated during the first twelve hours. When all surgeons will handle the intestines with gentleness, operate quickly, and otherwise reduce the chances of shock, it is probable that the prognosis will be greatly improved. Perforations of the descending colon and sigmoid flexure are seldom fatal; those of the transverse colon give a worse prognosis, by the formation of fistulæ, adhesions, and abnormal communications. Again, diathetic conditions may compromise recovery.

Notwithstanding great injury and other conditions greatly reducing the chances of recovery, recoveries are occasionally obtained.

> The omentum, although it does not contain unstriped or striped muscular tissue, has power of mobility, and applies itself over lesions that may occur in the cavity of the peritoneum. Thanks to the omentum, aseptic surgical wounds of the ureter, bile-ducts, etc., can be left to heal without sutures, since it practically walls in the wound. Millan (Gaz. des Hôp., July 1, '99).
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> Case of abdominal injury caused by the horn of rhinoceros in which a portion of several knuckles of gut protruded through the opening, two inches above Poupart's ligament. The gut was cleansed and returned and the parietal peritoneum, skin, and superficial fascia then closed by different sets of sutures. In eleven days was up and around. E. W. Waters (Brit. Med. Jour., Nov. 3, 1900).

Stomach. — Uncomplicated wounds of this organ frequently yield without trouble when the bullet, blade, or other instrument causing the perforation is small, especially if the stomach was empty at the time the injury was inflicted. The mucous membrane bulges out and forms a plug which obturates the hole until reparative processes have sealed the aperture on the peritoneal side. Complicated cases, in which the lesions are extensive, soon reach a fatal issue if deprived of timely surgical intervention.

> An individual shot when the stomach is distended with food will have a better chance to recover if subjected to an operation and the peritoneal cavity washed out. The probability is that during efforts at vomiting part of the contents of stomach will be extruded through perforations into peritoneal cavity. R. B. Hall (Cincinnati Lancet-Clinic, May 7, '98).

Liver. — The prognosis of wounds of the liver depends mainly upon the com-

plications. If the patient does not die from hæmorrhage soon after the receipt of the injury, he is still exposed to the results of extravasation into the peritoneal cavity, the presence in the liver of a foreign body,—the bullet and what material it may have forced into the wounds,—etc. Peritonitis, hepatitis, and abscess are, therefore, dangers to be taken into consideration. Hepatitis and abscess are much less to be feared, however, from stab wounds, no foreign body being left behind, unless, as in dueling, the sword-point strike the spinal column, causing the blade to break. In such an event, however, the hæmorrhage would probably prove mortal very rapidly.

As to mortality, the statistics of Edler, Mayer, and others show it to average about 50 per cent., including the cases attended by complications.

> Records of 272 cases of wounds and injuries of the liver. Cases divided into those due to direct and those due to indirect violence. Direct injuries, 164 cases, with 58 deaths,—a mortality of 35.3 per cent.; indirect, 108 cases, with 92 deaths,—a mortality of 85.2 per cent. The former class again divided into two groups, of 54 punctured or incised wounds, 24, or 44 per cent., proved fatal, while of 110 gunshot wounds only 34, or 30 per cent., were mortal. Of the 272 cases, 150, or 50.5 per cent., died. These figures correspond very closely with the tables of Edler, which showed a mortality of 39.1 per cent. after shot wounds and 55 per cent. of all cases. Homer Gage and R. Lorini (Boston Med. and Surg. Jour., Apr. 28, '92).

Spleen.—Slight punctured wounds of the spleen are not mortal unless complicated with laceration of a large artery. They are sometimes followed by abscesses which heal after a prolonged period in the great majority of cases. Severe punctured wounds are dangerous in proportion, but if the primary hæmorrhage is not such as to cause an early fatal issue, the chances of recovery are about those of slight wounds.

Gunshot wounds are much more serious as a result of rupture of the spleen taking place under the concussion, when the bullet is large and its velocity is great. Fatal hæmorrhage quickly ensues. Rupture of the spleen may also occur during convalescence.

> Case of wound in the right hypochondriac region from which the spleen was protruding. Wound had been exposed to soiled clothing and a septic process feared. The entire spleen was removed. Recovery followed and in two weeks the wound had completely healed. O. St. John Moses (Lancet, Jan. 27, 1900).

During the War of the Rebellion the proportion of deaths was 93 per cent. In civil life, however, the weapons used are, as a rule, less powerful, and it is probable that the mortality, especially since antiseptic surgery has been generally utilized, is much smaller. The predilection of this organ for abscess greatly darkens the prospects of recovery.

Kidneys.—Complications are also to be feared in lesions of this organ, namely: peritonitis, nephritis, and secondary hæmorrhage. Again, the position of the kidney makes it probable that other organs are also injured in the majority of cases. The direction from which the bullet or stab came, the length of the penetrating blade, etc., are important factors when the nature of the injury is to be determined.

Bladder. — Gunshot wounds of the bladder are always serious as far as complications are concerned, rectal, vaginal, perineal, and scrotal fistulæ being very frequent.

As to the mortality of penetrating wounds of the bladder, it is not so great as in lesions of any of the other abdominal organs. Stab wounds are more frequently mortal than uncomplicated

bullet wounds, the proportions being 29 per cent. in the former and 17 per cent. in the latter. When, however, osseous lesions are also present, penetration or fracture of the pelvis, etc., the mortality reaches 29 per cent.

> Case in which a crow-bar entered the right thigh in front and emerged below the right shoulder posteriorly about an inch and a half below the angle of the right scapula. Notwithstanding toxæmia, hepatic rupture, and the presence of septic fluid in the thorax, patient survived the injury three weeks. A. C. Miller (Edinburgh Med. Jour., Oct., '99).

Treatment. — The preliminary measures indicated in the treatment of complicated contusions of the abdomen are also applicable in that of penetrating wounds of that cavity. Protrusion of portions of the intestines, the mesentery, and the omentum through the external wound is an early complication met with in many cases of penetrating wound. If the protruding mass be intestinal and in good condition it should at once be returned into the abdomen. An easy way of accomplishing this (recommended by Levis) is to raise the middle of the patient's body by means of a pillow, the hands, etc., while he is lying on his back. The anterior portion of the pelvis is thus separated to an abnormal degree from the anterior portion of the thorax, and the increased room in the abdominal cavity thus obtained causes the intestines to spread out, as it were, and, their weight causing traction upon the protruding loop, the latter quickly slips in. At times accumulation of gas or fæcal matter checks its inward progress; the gas can easily be let out by inserting a clean hypodermic needle into the projecting bowel; the fæcal matter can also be reduced in quantity by drawing out an additional portion of the gut—thus increasing the size of the loop—and gently pressing small portions of the contents into the unprolapsed bowel, thus diminishing the tension of the protruded mass. It is sometimes necessary to enlarge the abdominal wound. If the projecting mass be greatly inflamed the latter procedure is unavoidable. If it be gangrenous it had better be incised and the formation of a fæcal fistula permitted.

An omental protrusion, if healthy, can be immediately returned, but if greatly inflamed or gangrenous it should be transfixed near the abdominal wall and tied with a double ligature; then excised. The stump is then secured in the deeper portion of the wound with ligatures and adhesive strips.

Punctured wounds of the abdomen are frequently recovered from spontaneously, owing to the absence of serious visceral lesions. The same statement may be made as regards bullet wounds, but with less emphasis. That laparotomy should be performed in every case is a view that wide-spread clinical testimony does not sustain; but that a wound of sufficient importance to cause anxiety be enlarged down to the peritoneum to allow of a careful examination and adequate procedures, if need be, and that laparotomy proper should be reserved for lesions which, from the nature of the symptoms, tend toward a fatal issue, is in keeping with the teachings of the most advanced, but safe, surgery.

> The wound of entrance should be enlarged, and, if the missile has entered the abdomen, a section is called for. Operation is proper soon after the injury, before the peritoneal membrane has become infected or much blood lost. Tiffany (Amer. Jour. Med. Sci., May, '96).
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> Hyperæsthesia of the abdomen is an indication for operation. An increase in the respirations to twenty-eight or thirty

per minute is an absolute indication for operating. Cold extremities are also significant. Le Dentu (Le Progrès Méd., Oct. 27, '97).

When surgical measures become necessary, including enlargement of the wound, the patient should be placed under an anæsthetic. The rectum should be emptied by copious injections containing a tablespoonful of glycerin to the pint. A subcutaneous injection of morphine ($^1/_4$ grain) is recommended by many surgeons. If, however, there is a tendency to shock without much pain, this agent had better be withheld. Rectal injections of whisky and warm water, 2 ounces of the former and 4 of the latter, is useful to sustain cardiac action. It may be repeated in an hour if evidences of impending shock are still present.

If, after a careful examination of the enlarged wound, it is found that the peritoneum is not involved, the exposed tissues are carefully cleansed and the wound is closed, deep sutures being used to hold the tissues in accurate apposition. As already stated, the possibility of ventral hernia should be borne in mind: the patient should be kept in bed for some time and a bandage be worn until all local weakness has disappeared.

If, after a stab wound, the parietal peritoneum alone is found incised or penetrated and there is no evidence that the organs behind have suffered injury, the tissues must be cleansed with great care and the peritoneal flaps brought together, the serous surfaces being kept in contact. A continuous catgut suture is used for the peritoneum; the muscles and skin are then united and the wound is closed. The measures already outlined to prevent ventral hernia are also indicated for the deeper wound.

When laparotomy becomes necessary the incision should be made in a spot affording the operator the greatest opportunity for a wide field of action, and should be sufficiently long. When performed for the arrest of dangerous hæmorrhage, a long median incision will enable the surgeon to reach any organ with ease: an important factor, for the missile or blade inflicting the injury may have traversed harmlessly between several coils of intestine and have caused a rent in the organ most remote from the point of entrance. Again, the incision should be free, so as to make it possible to easily reach all parts of the abdomen to allow of a thorough removal of all extravasations which might otherwise ultimately cause complications.

Case ending fatally through the fact that a too limited parietal incision had been made. A longer incision would have permitted more extensive irrigation and prevented peritonitis, which developed in the upper portion of the abdomen. Dubujadoux (Archives de Méd. et de Pharm. Militaires, Aug., '95).

In most cases of perforating wound when operation is decided on it is a good plan to make the incision through the point of entrance, and, when necessary, to apply silk-thread retractors. Charred tissue must be excised, and the part injured secured with fingers or forceps and drawn out, surrounded by gauze or sponges, and dealt with by suture or excision as the case requires. When flushing is employed for the removal of foreign matter or extravasated fluid, some clean water left within the cavity often has a very beneficial effect. In hepatic injury often the chief difficulty is hæmorrhage. This, however, can be stopped by pressure with or without perchloride of iron or suture. Wounds of the intestine can be treated expeditiously by the aid of some sort of contrivance; but, of all the mechanical instruments introduced, Murphy's button is the best. J. Ward Cousins (Brit. Med. Jour., Oct. 21, '99).

One of the important elements of success in the treatment of gunshot and stab wounds of the stomach is time. Unnecessary time lost in finding and suturing the visceral wounds is a source of immediate danger to life which should be eliminated as far as possible by means which enable the surgeon to

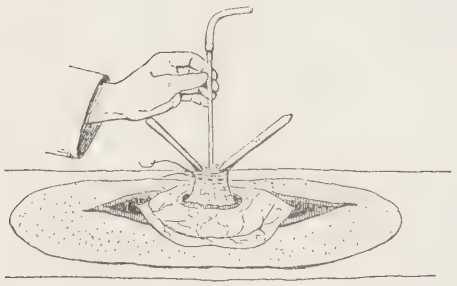

Fig. 1.—Suturing of posterior wound through anterior. Purse-string catgut suture in place. *(N. Senn.)*

(British Medical Journal, Nov. 8, 1902.)

make a quick and correct diagnosis, and by resorting to a method of suturing which closes the wound safely and securely with the least possible delay, and which leaves it in a condition most favorable for speedy definite healing. It is well known that small penetrating wounds of the stomach often heal without operative intervention. By contraction and relative displacement of the different muscular layers of the thick wall of the stomach the tubular wound is contracted and obstructed sufficiently to prevent leakage until the canal on the peritoneal side becomes hermetically sealed by firm plastic adhesions which prevent extravasation during the time required for the repair of the visceral wound. If in larger wounds of the stomach the same degree of occlusion can be accomplished by the simplest mechanical means, then such a procedure should take the place of the more time-consuming methods of suturing now in general use. This can be accomplished with the purse-string suture.

In gunshot injuries the defect in the stomach-wall is circular and the wound-margins contused; hence the deep sutures could at best furnish a barrier to the escape of stomach-contents only for a short time, as their hold in the necrosed tissues would be imperfect and only of brief duration. In short, round wounds the circular suture is the one which will bring and hold together in permanent uninterrupted contact the serous surfaces in the most efficient manner. In the treatment of gunshot wounds of the stomach the principal object of suturing should be to close the perforation in such a way as to guard securely against extravasation, and at the same time approximate and hold in apposition a maximum surface of intact healthy peritoneum. This is accomplished by making a cone of the injured part of the stomach, with the apex corresponding with the wound directed toward the lumen of the organ. The purse-string suture, applied in a manner that will be described in the experimental part of this paper, will maintain this cone until the healing of the visceral wound has advanced sufficiently to render further mechanical support superfluous. The cone on the mucous side of the stomach acts in the manner of a valve, which in itself is an effective

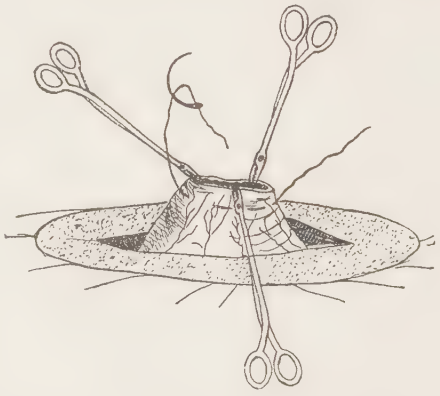

Fig. 2.—Purse-string silk suture in place. *(N. Senn.)*

(British Medical Journal, Nov. 8, 1902.)

barrier against the escape of stomach-contents, while the circular suture constitutes almost an absolute safeguard against leakage, and brings in contact the serous surfaces in the interior of the cone. For wounds of the posterior wall of the stomach the author recommends a purse-string suture of heavy

durable catgut to be applied through the anterior wound. The anterior wound is closed with a purse-string suture of silk of medium size applied to the base of the cone on the serous side. It is desirable that the circular suture should cause no necrosis of the included tissues. By using an absorbable suture in closing the posterior wound in the interior of the stomach this object is

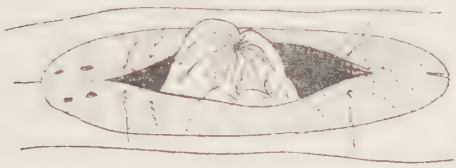

Fig. 3.—Showing result of purse-string silk suture closing anterior wound in stomach-wall. *(N. Senn.)*

(British Medical Journal, Nov. 8, 1902.)

gained, as only a small part of the thickness of the stomach-wall is subjected to pressure, and the tension caused by the ligature is gradually lessened by softening of its material, and is entirely removed by the absorption and digestion of the ligature in less than three weeks.

The wound of the posterior wall of the stomach is found and made accessible by inserting through the anterior wound a grasping forceps with which the posterior wall is seized at a point where, from the course of the bullet, the second wound is supposed to be located. Through a wound large enough to admit the index finger the greater part of the posterior wall of the stomach can be made accessible to sight and touch, and the perforation can be located and closed with the purse-string suture in a few moments. In doubtful cases inflation of the stomach should invariably be practiced for the detection of a second and possibly a third perforation.

The experiments demonstrated the safety of the circular suture in the treatment of gunshot and other penetrating wounds of the stomach. All of the animals operated upon in this manner recovered, and the repair of the injuries as shown by the specimens are ideal. The absence of adhesions over the posterior wound and their constant presence over the anterior wound indicate that the presence of the silk ligature and the needle punctures were the causes of the circumscribed plastic peritonitis which produced them. In none of the specimens could any indications be found of necrosis of any of the inverted tissues, and included in part by the circular suture.

In the course of three weeks the continuity of the mucosa at the seat of the injury was completely restored. The result of these experiments has convinced the author that the circular suture compares favorably with the methods of suturing in general use, and besides has the great advantages over them in the ease of its application and the saving of much valuable time.

Suturing of the posterior wound by partial eversion of the stomach through the anterior obviates unnecessary hand-

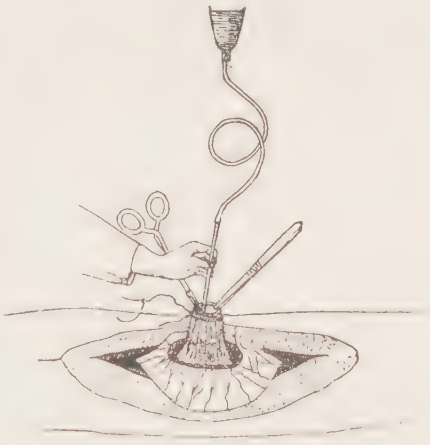

Fig. 4.—Showing irrigation of bursa omentalis through the opening in the posterior wall of the stomach. *(N. Senn.)*

(British Medical Journal, Nov. 8, 1902.)

ling of the organ and the necessity of interfering with the vascular supply incident to exposure of the posterior wound, as is done by the methods now generally practiced. If extravasation into the retrogastric space has taken place, flushing through the posterior

wound and a vertical slit in the gastrocolic ligament and gauze drainage through the latter are invariably indicated. N. Senn (Brit. Med. Jour., Nov. 8, 1902).

The stomach and the transverse colon are best brought to view by an incision in the linea alba. In the case of the stomach hernia of the mucous membrane will facilitate recognition of the lesion. The ascending colon requires lateral incision on the right side, and the descending on the left. These also should be sufficiently long to facilitate the search for the injury or injuries that may be present in the organ itself and beyond.

The incision may be such as to intersect the wound of entrance. This is desirable at all times, the aim being, of course, to always avoid unnecessary solutions of continuity. Such an incision can fortunately be made in many of the cases in which the hæmorrhage is not formidable.

Hæmorrhage. — When the abdominal cavity is opened and the hæmorrhage, which is usually more venous than arterial, is marked, the blood rapidly accumulates in the most depressed portion of the cavity from an invisible source. To mop out the blood with sponges is generally recommended; but such a procedure does not cause the hæmorrhage to cease,—the first *desideratum.* In these formidable cases an assistant should at once introduce his hand through the wound—hence the advisability of a long incision—and compress the abdominal aorta below the diaphragm. This procedure immediately checks the flow. Carefully cleansed and disinfected sponges having been made ready in the meantime, the blood present is quickly, but not roughly, sponged out. When this is finished the source of hæmorrhage is sought after. If any difficulty is experienced, the digital pressure upon the aorta may, for an instant, be decreased, and a sudden gush will point to at least the direction from which the blood comes. The necessary steps are then taken to arrest the flow, and the abdominal aorta is released as soon as possible,—not suddenly, but by a gradual reduction of pressure.

The measures to be adapted in arresting hæmorrhage vary according to the organ involved. Gunshot wounds of the liver are frequently stellate, and rents, radiating from the bullet-track in various directions, greatly increase the bleeding surface, the parenchyma in this organ taking part to a great degree in the emission of blood. To force resilient sponges into these tears is to increase their depth. If the wound be not very extensive, it may be sutured with catgut or cauterized with the actual cautery. If the wound is extensive it had better be packed with long strips of iodoform gauze, one end of which is brought out of the external wound.

Five cases of wounds of liver: two by fire-arms and three by a cutting instrument. Two great dangers are hæmorrhage and infection. Immediately after accident, if there is indication of internal hæmorrhage, exploratory laparotomy should be performed. For control of hæmorrhage tampon may be utilized in grave cases, where work must be done quickly. Suture is method of election. Statistics show, out of 50 cases of operative interference in hepatic wounds, 36 resulted in a cure and 14 ended fatally. L. Walton (Amer. Medico-Surg. Bull., Jan. 10, '98).

The spleen is next in order as to profuseness of hæmorrhage. The same procedures may be adopted as for the liver, but the introduction of iodoform strips is to be preferred. If these means fail, splenectomy is the only measure left.

Sometimes a portion of the organ projects through the wound; removal of the protruding portion should be practiced after passing a ligature around the mass.

> Case of prolapse of spleen through a perforating wound of the abdomen of three weeks' standing. Spleen at first considered to be the liver, though on the left side, on account of the size, shape, and color of the organ. Attempts to reduce it failed. It slowly contracted, becoming, within a month, less, by half, in size, and contracted very firm adhesions to the skin, the peritoneal cavity, meanwhile, being completely shut off. As there had been a compound fracture of the tenth rib, with subsequent necrosis of the broken ends of the bone, a sinus remained, leading from the prolapsed organ to the bone; and here the adhesions were very vascular. The pleura had escaped uninjured. Splenectomy. Uneventful recovery. E. Harold Brown (Brit. Med. Jour., Jan. 16, '97).

The walls of the stomach and intestines may also give rise to marked hæmorrhage notwithstanding their comparative thinness. The number of vessels coursing through them, however, is very great. In these cases it is best to hem the margins of the wounds with fine silk. The bladder may be treated in the same way.

The mesentery sometimes bleeds profusely when perforated. The mesenteric vessels should be ligated *en masse* with fine silk.

Hæmorrhage of the kidney is arrested in the majority of cases by iodoform-gauze package. If this should prove ineffectual the organ must be exposed and the vessels tied if possible. If not, nephrotomy or nephrectomy should be resorted to. The latter operation does away with the chances of complication attending the former, while the kidney of the other side assumes the function of both.

> Case in which the patient, a boy of 8 years, was shot by his brother with a small Flobert pistol, the bullet entering just above the os pubis and passing down toward the right. Considerable urine extruded from the wound, and œdema of the scrotum and penis appeared. Incisions allowed the escape of considerable urine and the bullet was also extruded. The patient rapidly recovered. B. Bayerl (Münchener med. Woch., May 7, 1901).

Perforation. — To detect the presence of a perforation and its location, Senn's hydrogen test, already mentioned, may be employed.

> Senn's method of hydrogen-gas insufflation, however admissible in recent cases, should be used with great caution after the lapse of a few hours. The distension and motion of the intestines caused by the insufflation might rupture inflammatory adhesions, burst open intestinal wounds that had nearly healed, and make a peritonitis general which had become circumscribed. McGraw (Trans. Amer. Surg. Assoc., vol. vii, '89).

The fact that the intestines are, at times, perforated in twenty spots by a bullet suggests the considerable degree of care that should be given to this part of the procedure, which is carried out in the following way: The perforation nearest the rectum having been detected, the portion of intestine perforated is gently brought into full view. An assistant causes the gas in the portion of gut below the laceration to escape through the latter by slight pressure. This being done, the next step is to ascertain whether there is another perforation above. A fresh, perfectly aseptic glass tube is placed at the end of the insufflating tube and introduced into the wound with the tip directed away from the rectum. The assistant now being directed to compress the intestine below the perforation, a small amount of gas

blown above the latter will inflate the upper segment if there is no opening, or indicate the location of the perforation if there is one. As soon as the latter is detected, the tube is withdrawn, the neighboring intestine on each side of the first perforation is disinfected, and the opening is closed. This procedure is renewed until all perforations have been found and closed. This plan renders unnecessary the removal of the intestines from the abdominal cavity during any part of the operation, the source of complications in many cases, and of death by aggravated shock in others, and is now recommended by the majority of American surgeons.

There is great ground for the objection to Senn's method, made by many surgeons, as regards its use for purposes of diagnosis prior to laparotomy, but, in the detection of perforations after the abdomen has been opened, it is of value, and may be used, at times, to great advantage.

The manner of closing the wound is that indicated for lacerations following blows. The stomach and intestinal perforations being treated in the same way, the margins of the wound are turned inward and the serous surfaces are united by a continuous, fine-silk Lembert suture or by interrupted sutures, including the serous and muscular coats and the submucosa. These are cut short and left in, being eventually discharged *per anum*.

At times the tissues around a perforation are sufficiently contused to render an omental graft necessary.

Enterectomy is sometimes required, and not infrequently exsections of the intestine are necessary. In that case the intervening portion, if it is not too long, had better be resected, thus avoiding a double operation in the continuity of the gut.

Case with six intestinal perforations and wound in bladder 4 centimetres long. Resection of 62 centimetres of small intestine. Slight cystitis; recovery uneventful. Rieder (Le Bull. Méd., Jan. 3, '95).

After the active measures described have been carried out the extravasation of the contents of the stomach or intestines may make it necessary to flush the peritoneal cavity. Warm, sterilized water should be used, but care should be taken not to handle the intestines roughly. By turning the patient on his side the fluid is poured out. The abdominal cavity is then dried with large sponges wrung out of warm, sterilized water. Chilling of the viscera should be carefully avoided, and the parts should be exposed to the air as short a time as possible.

Case of stab wound illustrating the value of salt solution. Within the abdomen, where only salt solution was used, no inflammation or trouble followed; whereas at the abdominal wound, where bichloride, etc., were used, suppuration took place. P. R. Bolton (Med. Record, July 31, '97).

Case in which cœliotomy for gunshot wounds disclosed fourteen perforations of the small intestine. Closed with continuous and Lembert suture. Abdominal cavity flushed with saline solution, drained with gauze; recovery. George Sherrill (Med. Record, Oct. 7, '99).

Drainage is sometimes necessary, especially for wounds of the solid viscera, such as the liver, spleen, kidneys, etc., in which active measures were not resorted to early.

In abdominal surgery the weight of evidence stands in favor of dispensing with drainage whenever it is possible. Method of closing abdominal wound layer by layer has greatest number of advocates, and materials mostly used for sutures are catgut, chromicized catgut, silk-worm gut, and silver wire. Causes of post-operative wound-infection are unnecessary manifestations of wound,

rough retraction of its edges and prolonged pressure with metal retractors, imperfect hæmostases, strangulation of large bits of tissue by ligatures, and undue tension of the sutures. A. C. Heffenger (Med. Record, Dec. 17, '98).

Case of attempted suicide in which the intestine was wounded with a pair of scissors. The intestinal wounds were closed with silk, mostly by interrupted sutures, and a gauze drain was carried out of the median end of the wound and the walls of the abdomen closed. Recovery. Deiters (Münch. med. Woch., Sept. 4, 1900).

To summarize: we will say that immediate exploration of the abdominal cavity is indicated as soon as it is suspected to have been penetrated or in any way injured by a traumatism. The injury to its contents must then be repaired under strict aseptic precautions. The value of salt-solution flushing is emphasized by the results of practical experience.

Should no lesion be found, the mere exploration should result in no serious damage.

After-treatment. — Food should be withheld for thirty-six hours, but a little water and brandy, in teaspoonful doses, may be allowed, especially if there is any degree of shock. In that case it is advisable also to use stimulants by the rectum or subcutaneously. Nutritive enemata of beef-tea and milk are necessary to sustain the patient's powers.

In three cases that recovered one had 16 wounds of the small intestine; one, 14, and another, 10, and it would seem almost impossible to imagine that recovery could have taken place in these cases without operation. The after-treatment is regarded as all-important. During the first twenty-four hours only cracked ice was allowed and stimulants. On the second day the patients were fed with chicken-broth at intervals of two to four hours. Rectal feeding with predigested foods and alcohol was practiced. A. B. Miles (Annals of Surg., Dec., '93).

The bowels should be kept freely movable. Large doses of Epsom salts sometimes serve to thwart the danger of peritonitis, without compromising the intestinal wounds, by removing all noxious material that may have accumulated in the bowel.

Liquid food may be permitted by the evening of the second day, and soft, easily digested food after a week, rectal alimentation being continued until then.

The sutures can be removed on the ninth day. The closure of the external wound must be complete before the patient can be allowed to leave his bed, and the danger of a ventral hernia should be counteracted by means of an abdominal supporter.

Hypodermic injections of strychnine, $^1/_{60}$ to $^1/_{30}$ grain, three times a day, according to indications, will prove most effectual in maintaining the strength of the patient and toning the muscular wall of the intestine.

Wounds Due to Military Fire-arms.

[See *supra*, PENETRATING WOUNDS, for details.]

During the Franco-Prussian War German soldiers were frequently found suffering from wounds of so frightful a nature that the French were accused of using explosive bullets contrary to the International Convention to that effect. Wounded limbs showed lesions of so destructive a character that the hole made was a *magma* of muscle, tendon, bone, blood, etc. Dead subjects were found with their heads completely shattered, the brains being scattered on all sides. The good faith of the French was soon demonstrated, however, experiments having shown that their rifle, the Chassepot, was capable, when fired at close quarters, of creating unusual lesions on account of the initial velocity and the greater rotation of the bullet. This was

attributed mainly to the reduced diameter of the bore, 11millimetres, and to the increased quantity of powder used.

In 1886 France adopted 8 millimetres as the calibre of her military arm, and the other nations soon followed her example. The United States Government adopted two calibres, one of 7.62 millimetres for the army, and one of 6 millimetres for the navy. Contrary to all expectations, the effects noted in recent wars, the war between Chili and Peru, in which a 7.6-millimetre calibre was used; that between China and Japan, in which a 7.9-millimetre was used on the Japanese side, and the more recent Chitral expeditions and Abyssinian campaigns, in which 7.9-millimetre and 6.5-millimetre arms, respectively, were employed, were less destructive than the larger calibres, while the wounds caused by them healed with greater rapidity than those following lesion due to the action of larger balls. During the Chilian War there were instances where men completely perforated through the chest would suffer from slight shock, a slight hæmoptysis, and soon be out.

This radical difference between the destructive power of large and small calibres, or, rather, between the destructive effects of an arm such as the Chassepot (11 millimetres) and the modern rifle (6 to 8 millimetres), is mainly attributed to the fact that lead was formerly employed in the manufacture of bullets; whereas, at present, in order to avoid destruction of the bullet during its progress through the barrel, resulting from the great increase of the powder-charge, and with the view of reducing the weight carried by the soldier, owing to the introduction of repeating arms, the bullet itself is either made of some hard metal, or it is covered with some such substance as nickel, steel, German silver, etc.

These physical features, added to the smaller diameter of the projectile, the much greater velocity with which it travels, its more or less pointed tip, causes it to penetrate soft tissues as would a long, thin blade, separating rather than destroying them. Therefore perforations in a muscle are clean-cut; at times their walls are even collapsed; as a rule, the channel is about the size of the bullet; large blood-vessels are severed and bleed until the heart ceases to beat, etc.

Experiments on dead bodies seemed to show that very different effects were to be expected as soon as any resistance was offered to the passage of the bullet. When the skull was struck even at long range (1100 metres, Kocher), for instance, the brain was completely disorganized and the skull was fractured in all directions, while at short range explosion of the head might be said to have taken place. But experiments on dead bodies are now known to furnish but little accurate information as regards the effect of projectiles, the living tissues being affected differently. At short range destructive effects on soft and hard tissues are produced, but these do not vary from those by older weapons at equal distances.

Accepting only as evidence that furnished by the use of small-calibre bullets on the living, it may be said that the arms now furnished to armies do not give rise to injuries such as those met with in civil life, when weapons of various kinds, imparting to bullets a much smaller velocity, are used.

It is evident, judging by the practical evidence at present at our disposal, that military gunshot wounds cannot be considered absolutely as belonging to the category reviewed in this article. But it is only a question of degree as to the

injuries inflicted, and the military surgeon, by exercising his usual powers of discernment, will find a larger number of curable cases, whenever the severe hæmorrhages frequently attending the use of these new weapons will not have caused death soon after the receipt of the injury.

Wounds of the thorax and abdomen divide themselves into penetrating and perforating. It must not be forgotten that a slight hæmoptysis may accompany the first type, from the mere impact of the blow. In all wounds the probe is always contra-indicated. As to the prognosis of chest wounds, statistics are very pessimistic, for, unless the cases die within the first two or three hours or are killed by meddlesome surgery, they recover in a vast majority of cases. It is certain that here a masterly inactivity should characterize the operator. In dealing with lodged balls the author cannot do better than quote Abernethy, who, in speaking to his students, said that when Sir Ralph Abercrombie, who had received a bullet in the thigh, was placed under the surgeon's care, "they groped and they groped and they groped, and Sir Ralph died." It must be remembered that perforating wounds of the abdomen do not in many cases enter through the abdominal wall. Many have entered via the pelvis or the chest. In wounds above the umbilicus, probably, there are 3 per cent. which penetrate without perforating. The direction of the bullet has importance, the antero-posterior being better than the oblique, and these, in turn, being more favorable than the flank-to-flank type. Prognosis is based properly upon the statistics of many cases. These in general show that unoperated cases give a 55-per-cent. mortality. In patients operated upon during the first 4 hours, there is but 15 per cent.; in 4 to 8 hours, 44 per cent.; in 9 to 12 hours, 63 per cent.; after 12 hours, 70 per cent. The speaker emphasizes the importance of early diagnosis. Fæcal extravasation usually does not occur until after the fourth hour. This is due partly to the intestinal paresis resulting from the impact. The treatment is to cover the wound and not handle it too much. Infusion of very free type and equally generous drainage, particularly in civil practice, are both indicated. Injuries of the posterior cavity call for posterior drainage. Seeking the ball is contra-indicated; unless, indeed, it comes into view without effort, it should be let alone. (William L. Rodman.)

Many men are led astray by the old and erroneous teaching that the circuitous route in the abdomen is an utter impossibility. It may chance that a spent bullet striking the skull may be deflected by the bone, but no bullet can be turned aside by the soft viscera. Another point is that the shape of the abdomen is constantly changing. It is by no means difficult to place an athlete in such a position of strain that the anterior abdominal wall is in contact with the backbone. This, no doubt, explains the anomalous conditions where bullets have traversed the abdomen without injuring the viscera. (McGraw.)

Army surgeons are averse to early operations on the field. The fact that officers who had lain in the open for twenty-four hours with no care save a protective dressing, with absolutely no food or drink, have recovered, is instructive; it may very likely be that such absence of eating or drinking is a *desideratum*. (Grant.)

The importance of venesection in incipient pneumonia following bullet wounds should not be overlooked. Shock is entirely distinct from hæmorrhage. (Roberts.)

All-important treatment in the case of chest wounds is absolute costal immobilization. The manner of accomplishing this is to put on a cast of either plaster of Paris or rubber plaster, extending from the umbilicus to and over the shoulders. (Ochsner.)

The prognosis depends very materially on whether the viscera are full or empty. If empty, the same forces which when full extrude food close the wound. The value of aseptic food has been altogether overestimated, for the alimentary canal contains about every known

pus-producing organism. It is the injury to the mucous membrane which kills the patient. (Laplace.)

In controlling the hæmorrhage from chest wounds a most valuable method was that of cording three extremities for fifteen minutes, then passing on to the fourth, alternating in this way for several hours. It serves the same purpose as venesection, but preserves the blood. The author has heard from a great many of his old students, who have been operating in the Philippines and Cuba, and gave their reports to him in detail. They agreed that on the battlefield operations cannot be done because of the absence of two essentials: fire and water. The value of morphine, pushed to its limit, which constitutes a so-called opium splint and which makes the patient comfortable, is probably a very important factor in saving lives. (Dawbarn.) Proc. Amer. Med. Assoc. (N. Y. Med. Jour., June 14, 1902).

The Russo-Japanese war, now in progress, is verifying the teachings just outlined.

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ABDOMINAL ANEURISM. See ANEURISM.

ABORTION.

Definition.—Abortion is a term used to denote the expulsion of the product of conception, alive or dead, during the first six months of pregnancy; or, more exactly, the expulsion of a product of pregnancy which has not yet attained the period of viability, thus including cases where the fœtus may perish during the sixth month of pregnancy and be delivered a month or so later.

A number of authorities, especially American and English, only apply the term "abortion" to expulsion of the ovum during the first three months, while "immature delivery" and "miscarriage" are applied to expulsion of the product of conception from the end of the third month to that of the seventh, —*i.e.*, from the formation of the placenta to the time the child becomes viable. When the expulsion takes place between the period of viability and the normal term of pregnancy, it is called "premature delivery."

Frequency.—It is difficult to ascertain the frequency of abortion (1) because during the first two months of pregnancy it often occurs without being detected; (2) because, when known and even when occurring at a late date, it is frequently allowed to go without treatment.

The statistics obtained in maternities give a proportion of one abortion to three normal pregnancies; but such a proportion cannot be accepted as a rule, lying-in hospitals receiving only women in an advanced state of pregnancy. It is generally admitted that spontaneous abortion occurs most frequently during the first three months of pregnancy.

Viability. — Until recently the fœtus was clinically looked upon as viable only after the seventh month; but more careful treatment—above all, the use of the incubator and of artificial feeding by means of the stomach-tube—has caused children born during the sixth month to be looked upon, clinically, as well as legally, as viable.

A very young fœtus may breathe after delivery. This occurred in three cases in the fifteenth, fifteenth, and nineteenth weeks respectively. In the first of these there were six respiratory movements before and five after severing the cord, the fœtus living one hour. In the second case the fœtus lived an hour and a half and breathed five times. The third fœtus lived but half an hour and breathed eight times. The autopsy showed air in the stomach, but the lungs were empty. Glöckner (Cent. f. Gyn., No. 1, '90).

In performing an autopsy upon a woman who is supposed to have at-

tempted abortion search should be made for the embryo or pieces of it, or for the placenta. If the uterus is empty, the thickness of its walls must be measured, and the insertion of the placenta sought, as this can be recognized up to the tenth day after the expulsion of the embryo. This is possible even later, if the uterus is kept in 90 per cent. alcohol. The examination of the ovaries is of only relative importance, as no positive signs exist there. Stains of meconium, if found, will prove the abortion. If an instrument has been used to cause abortion, traces of the damage done by it will be seen. This is especially true when the uterus has been perforated. Brouardel (Jour. des Praticiens, Jan. 12, 1901).

Symptoms.—Abortion is divided as to its symptomatology by the majority of obstetricians into four classes:—

1. Abortion occurring during the first month.

2. Abortion occurring during the second month.

3. Abortion occurring between the beginning of the third month and the end of the fourth month.

4. Abortion occurring during the fifth and sixth months.

After the third month the abortion presents very distinct clinical characters.

Abortion in general is usually preceded by dysmenorrhœal pains, extending as far as the loins, and a sensation of bearing down in the pelvis, or contractions of the uterus with or without hæmorrhage.

When the death of the fœtus precedes the abortion, the uterus ceases to increase in size, and all reflex symptoms caused by pregnancy disappear.

Abortion During the First Month.—This usually gives rise to symptoms simulating those of retarded menstruation. Slight pains in the back in the region of the uterus are complained of; the symptoms, in this particular, resemble those of normal labor, but are very much less marked. Blood, blood-clots, and flakes of the mucous membrane of the uterus are gradually expelled during several days. The ovum is expelled entire, but it is so small that it is rarely discovered.

Abortion During the Second Month.—Inasmuch as the uterus has decidedly increased in size as compared to the first month, the contractions and pains are proportionately stronger. The embryo is usually expelled inclosed in the unbroken membranes. Sometimes, however, the latter are ruptured.

The embryo and membranes may be detached from the uterus in two ways:

(*a*) By hæmorrhage between the membranes and the uterus, followed by uterine contraction.

(*b*) By contraction of the uterus, followed by hæmorrhage. In the latter case the abortion is more prolonged, the membranes being detached but slowly from the uterus.

If the embryo be still living, the abortion lasts longer, and the hæmorrhage is greater. If the embryo be dead, the whole is usually expelled like a foreign body, and without rupture of the membranes.

Examination of the uterus will show that it is increased in volume, and situated lower down in the pelvis than normally. The cervix is dilated, softened, and filled with blood-clots. The dilatation is more marked in multiparæ than in primiparæ.

The cervix, though dilated, does not become effaced; and the embryo contained in the unruptured membranes may pass through the cervix and be expelled. If the membranes are ruptured, however, the embryo passes by itself, the very thin umbilical cord breaks, and the cervix closes. The membranes are, in

this latter case, expelled later on. The membranes are ruptured about once in every two cases.

Abortion from the Beginning of the Third to the End of the Fourth Month.—This occurs nearly always in two stages, the first consisting in the expulsion of the fœtus, and the second in the expulsion of the membranes and placenta.

The cervix in this form of abortion tends to diminish in length. The uterine contractions act more powerfully than in the previous forms of abortion. Under their influence the membranes are ruptured and the fœtus is expelled.

The placenta may still be adherent; the cervix then closes again, and the placenta and membranes are expelled later on. Hæmorrhage is likely to accompany the delivery of the placenta and membranes, especially when the former is only partly detached. Under these circumstances each uterine contraction is accompanied by hæmorrhage.

The placenta may be already detached when the fœtus is expelled; in such a case it is likely to be expelled immediately after the latter, before the cervix closes, but part of the decidua may remain in the uterus after delivery of the placenta. This occurs most frequently when the fœtus is dead.

Statistics show that retention of the placenta occurs most frequently during this period.

> At three months the placental form is well established, and the uterine contents behave much as they do at full term, with these differences: the placenta is less firmly put together and is more firmly united to the uterus. There is danger, therefore, of masses of placenta being retained, even though much may be expelled. Ayers (N. Y. Med. Record, Sept. 28, '95).

Abortion During the Fifth and Sixth Months.—The fœtus and placenta are almost always expelled separately. Uterine contraction is more marked; the cervix tends to become more effaced and to dilate.

Delivery of the placenta usually follows delivery of the fœtus rapidly, and the tendency to hæmorrhage is less marked than in the previous forms of abortion.

Of 501 cases of abortion analyzed by Varnier and Brion, the fœtus, or embryo, and the placenta were expelled separately in 453, and together in 48 cases. When the delivery occurred in two stages, the time found to elapse between the expulsion of the fœtus and that of the placenta was as follows: 120 cases, within 15 minutes; 81 cases, from 15 to 30 minutes; 78 cases, from 30 to 60 minutes; 83 cases, from 1 to 4 hours.

> In 275 cases treated in the last two years of those cases terminating naturally expulsion of the whole ovum occurred in hospital in 145 cases. The remaining 39 were admitted with the placenta partially or entirely retained. Complete expulsion occurred after a period varying from a few hours to three days as a maximum. During this time rigorous antiseptic precautions were observed (douches, etc.). All these cases terminated favorably with two exceptions: one patient was septic on admission, and died of septicæmia; the other case died of pulmonary tuberculosis. Maygrier (L'Obstétrique, July, '97).

Whenever the placenta and membranes are not expelled within four hours after the expulsion of the fœtus, or embryo, there is retention of the membranes and placenta.

Abortion may take place suddenly, or resemble, in that particular, the irregular periodicity of normal labor, with more or less hæmorrhage. It may, indeed, last several days, owing to weakness of the uterine contractions or adhesions to the

Development of the ovum. (Caseaux Hunter, Erdl &c.)

Figures a and b. The ovum during the second and fourth week. Figure c. Section of the uterus (reduced) showing the thickened mucous membrane which is to furnish the decidua vera. Figures d and d'. The ovum at the end of the sixth week.

uterus or retention in the cervix of the masses to be expelled. (Rokitansky, Schülein.)

Sudden or rapid abortion is frequent during the first two months; when the expulsion takes place after the third month it generally presents the characters of normal delivery.

Pathology. — Abortion comprises a period of uterine dilatation, the expulsion of the ovum, and involution of the uterus; when delay occurs in any one of these three stages the abortion is protracted. The most frequent cause is failure of the os and cervix to dilate, resulting from a rigid condition of the tissues following laceration or previous inflammation. The internal os may be closed and the external os and cervix dilated, or the external os may be closed while the internal is dilated. The muscular wall of the lower portion of the uterus is thinned in abortion, so as to give a lower segment, which is as well marked in the aborting uterus as in the uterus in labor at full term. The peritoneum over this part of the uterus becomes loosened, as the result of the expansion of the muscular wall; and the decidua over the same area is also separated from the same cause. (Berry Hart.)

Complications.

Retention of the Secundines. — This is the most frequent complication of abortion, spontaneous or criminal, and may present either of the following characters: The placenta is non-adherent, but remains within the uterine cavity until finally expelled, either entire, or in pieces. As infection easily occurs in such a case, great attention should be paid to the temperature. The placenta remains completely adherent. When this is the case the placenta is expelled only some days later, as late even as thirty days after delivery of the fœtus.

The placenta is partly adherent and partly non-adherent. This is the most dangerous condition, as it is the most liable to be accompanied by hæmorrhage or septicæmia. Great care should be taken in such a case not to pull on the placenta, lest more hæmorrhage be produced by further detachment.

> An entire placenta in the uterus is not dangerous, but fragments rapidly give rise to grave symptoms. Bureau (Jour. de Méd., Apr. 3, '92).
>
> Case of a woman, aged 29, admitted into a maternity for extreme anæmia during her fifth pregnancy. The fundus reached as high as the umbilicus, and a prominent swelling as big as a fist projected from the right side of the uterus, which felt soft. The vagina was full of clot. The os admitted the tips of the two fingers, and the fœtal cranium could be felt behind the membranes, which were tense; no trace of a placenta could be found. A week later the waters escaped, and the ovum was discharged with the placenta, followed by a mass of clot the size of a fist. The patient did well. The detachment of the placenta was clearly the cause of the abortion, but what caused it to become detached was not determined by the history of the case. Lourich (Zentralb. f. Gynäk., No. 6, 1903).

Hæmorrhage.—Hæmorrhage may occur during the detachment of the ovum itself, during the detachment of the placenta immediately after delivery of the fœtus, or during detachment of the placenta, the latter occurring several days after delivery of the fœtus.

The blood may be normal and be at once expelled from the genital organs; or it may form a half-coagulated mass within the vagina. Masses of fibrin in the blood should be diagnosed from the ovum itself, for which they may be mistaken.

The symptoms are those of all forms

of hæmorrhage. When profuse there is a weak pulse, pallor, disturbances of hearing and sight, and vertigo.

The danger from the hæmorrhage is not so great as the general symptoms would often indicate; still, any serious loss might diminish resistance to infection.

Cases of hæmorrhage before miscarriage, indicating the advisability of rapidly bringing the abortion to an end when the loss of blood is serious. Martin (N. Y. Med. Jour., Feb., '92); Blood (Chicago Med. Times, Aug., '92); Hirst (Amer. Gyn. Jour., Feb., '92).

Inversion of the Uterus.—Inversion of the uterus is occasionally observed as a complication. The uterine wall should be handled with care when efforts at reduction are made, pressure with finger-tips being avoided.

But 1 case of inversion of uterus met with in 190,000 labors at Rotunda Hospital; 250,000 births were recorded in Vienna without a case. Case of patient who had three living children, but during fifteen months preceding entrance into hospital she had miscarried four times between third and fourth month. On fifth day following last miscarriage she flowed freely, with sudden pain in abdomen, attended with collapse. She remained in bed six weeks. Two days after getting up she felt that something came down and endeavored to keep it back with a cloth. Examination detected inversion of uterus. The mucous membrane of uterus showed no tendency to become dry and skin-like. Several days later uterus menstruated, which lasted four days. Under ether, reduction was accomplished only by making free incisions into the cervix and longitudinal incisions over uterine mucous membrane at region of internal os, in addition to continued pressure kept up on neck of swelling and over its surface. Patient subsequently became pregnant and was delivered at term without trouble. A. W. W. Lea (Med. Chronicle, vol. viii, No. 3, p. 177, '98).

Septicæmia.—Septicæmia frequently accompanies excessive hæmorrhage. It may be revealed by fœtidity of the lochia. The latter symptom is not invariably present, however, as no odor may be noticed, notwithstanding active septicæmia. Chill and high temperature may be considered as the positive signs of infection.

Case in which abortion was followed by septic endometritis, salpingitis, general peritonitis, and an abscess of each ovary. Dorsett (Weekly Med. Review, Feb. 14, '91).

Tetanus, etc. — Tetanus and other nervous disorders may follow abortion.

Case of tetanus following abortion at the fourth month. Brownlee (New England Med. Monthly, Nov., '91).

Case of hemiplegia following abortion. The cervix had been dilated with tampons to remove an adherent portion of the placenta. Fenwick (American Jour. of Obst., Apr., '91).

Case in which, twelve days after a supposed artificially produced abortion, a 30-year-old woman suffered from trismus and tetanus, the convulsions being severe and frequent. Successful treatment by means of antitoxin. Ch. F. Withington (Boston Med. and Surg. Jour., vol. cxxxiv, No. 3, '96).

Etiology.—The causes of abortion may be due to disorders affecting the father, the mother, or the fœtus itself.

Analysis of a large number of cases of abortion occurring in the author's practice gives the following conclusions: Habitual abortion gives 18.6 per cent. of the whole. Uterine diseases cause 50 per cent. of the abortions. Reflex causes, either simple or complicated, exist in 21.5 per cent. Syphilis affecting the fœtus, retroflexion, salpingitis, and rheumatism, each 7.1 per cent. There were 78.5 per cent. that subsequently bore children, and 21.5 remained sterile. Of these, 14.3 per cent. have incurable uterine affections or are past child-bearing, and 7.2 are healthy, but sterile. Leith Napier (Satellite of the Annual, Feb., '89).

Paternal Causes.—Abortion may be due to the following paternal influences:

Advanced age; lowered vitality, due to overwork or excesses, especially venereal; to syphilis and tuberculosis; and to noxious influences, such as lead poisoning and alcoholism.

Three cases of frequent abortions, due to lead poisoning from service-pipes, which ceased when the cause was removed. Swan (Brit. Med. Jour., Feb. 16, '89).

Case of a 37-year-old XVIII-para, who has aborted in the last sixteen pregnancies at between the fourth and the seventh months, after her husband became a house-painter, and soon after developed lead colic, followed by paralytic symptoms. She seemed free from any of the symptoms from which her husband suffered, and had not been subject to either tubercle, syphilis, or alcoholism. Before her husband had become a painter she had given birth to two healthy children. Daniel (Journal d'Accouchement, May 17, '96).

Maternal Causes. — Similar causes to those mentioned for the father act in the mother, and with more certainty if both parents are affected by them.

In addition the following noxious influences are to be noted: Tobacco (women employed in tobacco manufactories), carbon disulphide (women employed in India-rubber works), and carbonic oxide. To this latter agent is due the frequency of abortion in cooks, whose profession causes them to breath this deleterious gas during a portion of the day.

Bad hygienic surroundings, especially insufficient food, frequently promote abortion, while overfeeding and obesity (Stoltz) may also act as etiological factors.

Among local causes fibromyomata of the uterus and deviations (especially retroversion) are the most frequent causes.

Congestion of the uterus is a more important factor than retroflexion. Leith Napier (Brit. Med. Jour., Dec. 20, '90).

The predisposition to miscarriage in certain women is due to retroversion. Excellent results obtained from the use of pessaries when a miscarriage seemed imminent. Henry Coe (Int. Jour. of Surg., May, '92).

Two causes of successive abortions merit, in particular, the attention of the obstetrician: (1) uterine affections, and retroversion in particular; (2) syphilis. Schuhl (Nouv. Arch. d'Obst. et de Gyn., Feb., '92).

Analysis of 235 cases with reference to the causes. Syphilis is the most important cause, and accounts for 27 per cent. of the cases; retroflexion of the uterus is accountable for 18 per cent.; chronic metritis and endometritis, 10 to 15 per cent.; uterine fibroids, 4.7 per cent.; abnormal conditions of the placenta, 4 per cent.; anteflexion of the uterus, 3.5 to 6 per cent.; molar pregnancy, 1 per cent.; Bright's disease and lateral deviations of the uterus, 0.5 per cent. Römheld (Cent. f. Gyn., No. 39, '95).

Distinct local uterine conditions in otherwise healthy women: 1. Ill-developed uterus; the muscular coat does not readily soften, yet remains very irritable. Rare. 2. Displacements, especially flexions. Spur at the angle of flexion hypertrophies interferes with uterine development. 3. Congestion of the body and cervix, due to idiosyncrasies. Endometritis. Charpentier (Ann. de Gyn. et d'Obstét., May, '97).

Lacerations of the cervix, especially those of some depth, are a frequent cause of abortion. A primipara can usually give some cause for an abortion, such as a misstep or a fall, but in those who have previously borne children, where there is a fissure extending as high as the internal os that will admit the tip of the index finger, or the integrity of the lower uterine segments is lost, predisposition to abortion is undoubted. R. W. Rogers (Montreal Med. Jour., April, 1902).

Extensive laceration of the cervix, the fœtus in such a case not being sustained from below. (Olshausen, Schwartz.)

Old peritoneal lesions of the adnexa, especially ovarian cysts, come next in order as local etiological factors.

Genital Excesses.—These act especially by mechanical means. Young married women frequently abort five or six weeks after conception, on this account, while abortion is frequent among prostitutes for the same reason. (Parent Duchatelet.)

Acute or chronic general diseases, acting either by excess of temperature and changes in the composition of the blood or by alterations in the placenta.

Typhoid Fever. — Abortion occurs in about two-thirds of the cases of typhoid fever, and is more apt to take place during the earlier than the later months of pregnancy.

> Enteric fever materially influences the course of gestation, since abortion occurs in something like two-thirds of the cases. Thus, Sacquin collected 310 cases, and found abortion in 199; while Martinet found 66 abortions in 109 cases. W. Fordyce (Brit. Med. Jour., Feb. 19, '98).

The most prominent feature is uterine hæmorrhage, which is often the first symptom of impending abortion. The use of ergot is to be avoided in cases of pregnancy occurring in conjunction with typhoid fever. Other remedies, such as cold baths or even quinine, may be safely used. The history and treatment of the typhoid state proper remain unaffected by the co-existing pregnancy.

Pneumonia.—During the first months of pregnancy abortion occurs in more than one-third of the cases of pneumonia, but this complication occurs with increasing frequency the more advanced the pregnancy. Taking a general average of cases of abortion occurring during pneumonia, an estimate placing it at two-thirds of the cases is probably correct. The fœtus itself may suffer from pneumonic infection, and die soon after birth from pulmonary, meningeal, endocardial, or other lesions.

> Statistics of 213 cases of pneumonia during pregnancy: In 118 cases the pregnancy was interrupted, there being 42 abortions and 76 premature deliveries. Death of the mother occurred in 75 cases among the 213: a mortality of 35 per cent. The mortality of the mother is greater in premature deliveries than in abortion. S. Flatté (Thèse de Paris, '92).

Influenza. — It is probable that the marked nervous phenomena play a leading part in the production of abortion. The vasomotors bear the brunt of the toxic effects in the majority of cases, and the secondary results of vasomotor disturbance in the uterus, which is richly supplied with vessels, are obvious.

> Report of a number of abortions or premature deliveries resulting from influenza. Trossat (Lyon Méd., Mar. 11, '90).
>
> Doubt whether abortion and premature labor in influenza depend upon mechanical irritation from coughing and hyperæmia, with local congestion. It is very probable that in such cases the cause is infection from the uterine mucosa. Case of abortion occurring during influenza in a girl 19 years old; phlegmasia alba dolens developed three days after confinement, followed on the fifteenth day by pyæmic abscesses in the sternal region. Labadie-Lagrave (La Méd. Mod., Feb. 25, '92).

Measles.—This disease seldom occurs during pregnancy. According to some authorities measles and pregnancy have but little reciprocal influence. Of eleven cases collected by Klotz, however, nine were attended by premature delivery.

The influence of measles is but slight during the first months of pregnancy, and increases in gravity with the age of the pregnancy, the occurrence of this disease in childbed being generally fatal. Besides the danger of puerperal hæmorrhage, pneumonia is a frequent and formidable complication.

Scarlet Fever. — This disease rarely

complicates pregnancy, although it is comparatively frequent in the puerperal state. The period of invasion being frequently absent, it is probable, however, that it remains unrecognized, and that a larger proportion of cases of premature birth and abortion are caused by it than is generally supposed. In some cases the stage of incubation is prolonged to such a degree that the scarlet fever contracted during pregnancy is recognized only after delivery by the sudden development of the eruption over the entire body. Of 8 pregnant women suffering from scarlet fever, 6 who were from 4 to 6 months with child recovered without accident, 1 aborted at 3 months, and 1 had a premature delivery at 7 months (Legendre). The cases are generally characterized by high fever, emesis, marked congestion of the face, and sudden appearance of the eruption, which occasionally assumes a livid color.

Small-pox. — This disease manifests a preference for women in whom the pregnancy is not far advanced, but proves much more dangerous when it occurs near the parturient state. It attacks pregnant women oftener than any other disease. The probability of abortion varies with the intensity of the process present. Varioloid causes abortion in about one-tenth of the cases attacked (Mayer). Discreet variola causes abortion in about one-half the cases, while in confluent variola and hæmorrhagic variola abortion nearly always occurs, especially if the pregnancy be advanced.

The fœtus may be expelled during either one of the stages: invasion, eruption, or suppuration. It may present characteristic variolous cicatrices. Occasionally the child remains unaffected; it may also suffer from the disease before or soon after birth, the mother remaining immune.

Among 72 cases of small-pox in pregnant women, 31 miscarriages and 26 deaths. Sangregorio (Med. Standard, May, '88).

Abortion occurring during variola is usually attended with more than the ordinary amount of hæmorrhage. Gasparini (Gaz. Med. Lombarda, No. 18, '92; l'Union Méd., July 5, '92).

Several serious cases occurring during convalescence after small-pox. The grave symptoms are due to the retention of the fœtus, which has died during the acute stage of small-pox, and which is frequently only expelled during or after convalescence. Arnaud (Gaz. des Hôp., July 28, '92).

Cholera.—Women are the most susceptible to this disease during the later period of pregnancy. Abortion almost always occurs, even in comparatively slight attacks, and the prognosis for mother and child is most unfavorable. The abortion has been ascribed to uterine contractions, to acute hæmorrhagic endometritis, and to disturbance of the fœtal circulation caused by the thickening of the blood. It is probable that these three factors are present simultaneously, in addition to placental granular degeneration, which cause the death of the fœtus.

Icterus.—This disorder rarely presents itself during pregnancy. It may occur in three forms:—

(*a*) Simple catarrhal icterus, in which abortion frequently, though not always, occurs; (*b*) icterus gravis, in which abortion always occurs, and is almost invariably fatal; and (*c*) the epidemic icterus, peculiar to pregnant women, which causes abortion in the great majority of cases.

Icterus presents a peculiar feature that renders it important in connection with pregnancy: *i.e.*, its tendency to either precede or accompany the fatal pathological changes attending yellow atrophy of the liver. Pregnancy exerts a perni-

cious influence upon the course of even simple icterus, owing probably to the obstruction afforded not only to hepatic circulatory functions, but also those of the kidneys. This would tend to cause reabsorption of the biliary acids and to produce yellow atrophy. Fatal icterus during pregnancy is also due occasionally to the lesions attending phosphorus poisoning.

Malaria does not frequently complicate pregnancy, but causes abortion in about one-half of the cases attacked. Pregnancy seems occasionally to cause a relapse in women apparently cured of malarial fevers. On the other hand, parturition suspends periodical paroxysms, in a large proportion of the cases, for two or three weeks. The malarial paroxysms occurring during pregnancy are characterized by irregularity, and the fœtal movements may be suspended while the paroxysm lasts. Quinine may safely be given even in large doses, which best control the febrile phenomena. The case is different in habitual abortion (*q. v.*).

> Action of quinine on pregnant women. In 49 pregnancies quinine was used in 47, the patients suffering more or less severely from malarial fever. Of these, 47 cases terminated at the usual period by the birth of a child, and 2 aborted. In these 2 cases it is extremely probable that the high fever from which they suffered was instrumental in producing abortion. Medicinal doses of quinine are powerless to induce abortion. The drug may be safely given in therapeutic doses during pregnancy. 'O. Frederici (La Clinica Ostetrica, April, 1902).

Chorea rarely occurs as a complication, and especially affects primiparæ. It causes abortion in about one-half of the serious cases, and the exhaustion consequent upon the violent muscular movements occasionally proves fatal to the mother. The child, when parturition is approaching, may not be lost with the mother, but it is frequently affected with chorea. In a small proportion of cases of chorea paroxysms cease at the beginning of parturition.

Syphilis.—Whether contracted at the beginning or during the course of pregnancy, syphilis gives rise to very marked and widely spread initial symptoms, while the subsequent symptoms are mild.

When syphilis is contracted previous to conception, abortions occur repeatedly; but, as with time the date of the infection becomes more remote, the abortions occur at a later date in the course of the pregnancy, until premature delivery may occur, and finally delivery at term.

When conception and infection occur simultaneously, abortion is almost constant if no treatment be given; if immediate treatment be instituted the chances of abortion are somewhat reduced.

When infection occurs after conception has taken place, the nearer the two dates of conception and infection are to each other, the more will abortion be likely to occur. A thorough mercurial treatment should be inaugurated as soon as the presence of syphilis is known.

Diabetes. — This disease may complicate pregnancy either on account of its presence before conception, or it may occur during pregnancy only. Abortion occurs in about one-third of the cases, one-fourth of these ending fatally, generally by collapse. The child, though viable, usually perishes. This complication presents itself almost invariably in multiparæ.

Disease of the Heart. — The influence of cardiac disease upon pregnancy varies with the character and seat of the affection that may be present. Generally speaking, however, abortion and prema-

ture delivery are frequently observed: *i.e.*, in about two cases out of every five of heart trouble.

While acute pericarditis seems to bear practically no influence upon the normal course of the gestation, chronic pericarditis is a pernicious accompaniment of pregnancy, owing to the insufficient compensation afforded by the heart itself for pre-existing valvular lesions to satisfy the increased demand upon that organ. Acute endocarditis assumes increased dangers during pregnancy through a marked tendency to assume an ulcerative process, which generally ends fatally.

Mitral lesions, especially mitral stenosis and insufficiency, are considered by Germain Sée and Porak as the cardiac disorders most likely to cause death of the patient. If slight, however, or entirely compensated for, the parturition may occur without trouble. Intense passive pulmonary congestion, œdema, ascites, and metrorrhagia are to be feared in all such cases. Aortic insufficiency or stenosis is generally most marked in advanced pregnancy on account of increased arterial tension, but these untoward symptoms frequently disappear after parturition.

Pulmonary Diseases. — In the great majority of instances pregnancy hastens the development of phthisis, and precipitates its progress. In women predisposed to phthisis the probabilities as to the occurrence of this disease are thus increased by marriage. Although they sometimes escape it during the first pregnancy, the likelihood that the disease will show itself in future pregnancies is nevertheless great. Abortion or premature delivery is frequent in these cases, and the viability of the child is proportionate to the condition of the mother. Every effort should be made to thoroughly nourish such cases, overfeeding, milk, etc., forming the basis of the measures to be instituted.

Chronic pleurisy, empyema, and emphysema are liable to produce dilatation of the heart and thus render it incapable of compensating for the increased arterial tension of the parturient state. These conditions, however, are more dangerous to the mother than to the child; indeed, abortion under such circumstances sometimes saves the patient's life.

Traumatism. — Brutal treatment of pregnant women, falls, etc., are well-known causes. The farther removed from the genital organs is any traumatism the less likelihood is there of abortion being produced. Even small operations—the opening of an abscess, the extraction of teeth, etc.—have caused abortion.

> Case of abortion caused by the extraction of a tooth thirteen days before. Labor was immediately preceded by severe hæmorrhage from the dental alveolus. Poyntz (Indian Med. Record, Feb., '91).

Abortion may be due to too frequent pregnancies. Among other well-known causes may be cited long journeys or short journeys too frequently repeated; excessive walking, climbing, riding, or other physical exercise; falls, moral shocks, etc.

Causes Due to the Fœtus or Membranes.—Degeneration of the villosities of the chorion, hydramnion, and vicious insertion of the placenta are the main causes of abortion due to abnormalities of the fœtus and the secundines.

Prognosis.—The embryo, or fœtus, always perishes; the prognosis, therefore, only applies to the mother. Cases of spontaneous uncomplicated abortion almost always recover with proper care. The cause of the abortion, the date of the pregnancy, the degree of antisepsis

employed, or the previous cleanliness observed by the patient all bear influence upon the final issue of the case.

In Pinard's service the mortality of abortions was 0.81 per cent.; of abortions having begun outside the service, 27.5 per cent. At Bellevue Hospital no case of death has occurred since it has become customary in that institution to empty the uterus in every case of incomplete abortion. Out of 926 cases noted by Hirst there were 13 deaths: a mortality of 1.4 per cent.

As to the mortality of the product of conception, out of 434 cases in Pinard's service, the fœtus was born alive in 221, dead and macerated in 199, and died during delivery in 14 cases.

In abortion due to syphilis the fœtus is almost always dead and macerated; in abortion due to vicious insertion of the placenta, almost always alive; in albuminuria in about equal proportions.

Involution of the uterus is usually more rapid than after normal delivery, on account of the lesser size of the uterus. Incomplete delivery may be a cause of imperfect involution. Patients should be kept in bed ten days. Metritis is likely to be the sequel of abortion when the patient is allowed to leave her bed too soon. The influence of perfect involution on future pregnancies is marked.

A woman may lose immense quantities of blood in a threatened abortion, appear moribund from exsanguination, and yet rally and go on to full term under appropriate measures.

Diagnosis. — Pain, hæmorrhage, dilatation of the cervix, and descent of the ovum are the characteristic features of abortion which easily distinguish it from other disorders.

Dysmenorrhœa may be mistaken for impending miscarriage. In this disorder the cervix is closed and firm and the pain precedes hæmorrhage. In abortion, on the contrary, the cervix is open and soft and the hæmorrhage usually precedes the pains.

Organic lesions of the cervix—such as tumors, etc.—sometimes give rise to hæmorrhages; but the history of the case and a careful local examination will generally establish the nature of the condition present. A soft polypus may, however, resemble a small ovum, and increase the difficulty.

Hepatic colic and nephritic colic sometimes simulate labor-pains, but the absence of hæmorrhage from the vagina, and the intensity of the suffering, soon establish the identity of these diseases.

Threatened abortion being the condition present, the next point is to ascertain whether the abortion is inevitable.

Abortion is inevitable (1) when the membranes are ruptured, (2) when the fœtus is dead, or (3) when any fœtal part is already engaged in the cervix (Auvard). So long as symptoms of these three conditions are not present, abortion *may* not occur.

When symptoms, such as hæmorrhage, have occurred, it is often difficult to determine whether abortion has really taken place, and, if so, whether it is incomplete or complete. Uterine exploration may then become necessary.

During the first weeks of pregnancy the embryo may be so small as not to be easily found, and a positive diagnosis may not be established until, by subsequent events, continuation of pregnancy or involution of the uterus takes place. When the fœtus is dead it may remain in the uterus and the latter be thought, by the attending physician, to be empty. In some cases, even after hæmorrhages and the expulsion of portions of the secundines have taken place, the inter-

ruption of pregnancy has only been apparent.

Tubal abortion may simulate common abortion. The ovum is not invariably expelled from the ostium of the tube and discharged into the uterus. Case in which a complete decidua was discharged, the ovum being subsequently expelled. The diagnosis was supported by the detection of a thickening of the right cornu. Skutsch (Centralb. f. Gyn., No. 25, '97).

Spurious abortion. A class of cases in which a mimicry of early pregnancy and of abortion occurs quite different in its characters from the condition known as "spurious pregnancy." They are not associated with hysteria, and the usual functional disturbances of pregnancy are not exaggerated. They differ from pseudocyesis in the existence of definite changes in the uterus, and from pregnancy, either topic or ectopic, in the essential point of the absence of an ovum, a mimic abortion: in the occurrence of a period of amenorrhœa with enlargement of the uterus and formation within it of a body, the detachment and expulsion of which is followed by a return to menstrual regularity and the former condition of general health. The body expelled is not an ovum, but is formed entirely from menstrual structures. Three cases recorded.

A membrane having the essential characters of the decidua of pregnancy. Diagnosis impossible until after the discharge of the cast. T. W. Eden (London Lancet, Sept. 25, '97).

Tubal abortion and operation. A low mortality follows removal of a gravid tube in early pregnancy, when there are symptoms of internal hæmorrhage. On the other hand, a good number of diffuse intraperitoneal hæmorrhages do not kill, but end in the formation of an hæmatocele. Prognosis is very uncertain, and any case may end fatally. An exploratory incision through the vagina is advised, preparations being made, in any case, for abdominal section. The escape of blood-clot and broken-down tissue when Douglas's pouch is opened confirms the diagnosis of tubal abortion. The uterus and tubes can then be explored with the finger. If the tube is found ruptured, abdominal section is required; if there is simple and complete tubal abortion into the peritoneal cavity, Douglas's pouch should be drained. When the expulsion is incomplete, or there is a tubal mole, the ovum being retained in the tube, abdominal section and removal of the tube are indicated. Spinelli (Archivio Ital. di Ginec., June, 1901).

Treatment.

Threatened Abortion. — Absolute mental and physical rest is imperatively demanded. The patient should be kept in bed, with her hips slightly elevated, and be given only light and cool food.

To arrest the uterine contractions tincture of opium, 12 drops every two hours, may be given by the mouth; or extract of opium, 1 grain in a suppository, every three hours. If the pain is severe, morphia, $^1/_4$ grain, and atropia, $^1/_{60}$ grain, should be administered hypodermically. Laudanum enemata, 25 drops to $^1/_2$ pint of water, are also effective. If an idiosyncrasy preclude the use of opium, chloral-hydrate, 10 grains, and bromide of potassium, 20 grains, every two hours, then every three hours, may be used instead.

A good method is to administer opium, one-half of the dose under the form of laudanum enemata and the other half as subcutaneous injections of morphine (Ribemont). Constipation from the effect of the opium is to be avoided.

The fluid extract of viburnum prunifolium, $^1/_2$ to 1 drachm every three hours or 10 drops every half-hour, with chloral hydrate, 8 grains, is valuable to arrest uterine contractions when opium cannot be used on account of its constipating tendency.

The tincture of viburnum prunifolium is useful in cases where the membranes have been ruptured and the liquor

amnii discharged, but where there are still hopes of preventing a miscarriage. It should not be given, however, when the fœtus is dead, when a miscarriage has actually commenced, or when there is any reason why it is not best that birth should be delayed. Auvard (Boston Med. and Surg. Jour., Mar. 22, '88).

Viburnum paralyzes both the centres of voluntary motion and the reflex functions of the spinal cord without impairing sensation or consciousness, and it is consequently destined to become an approved remedy in all diseases characterized by increased excitability of the motor centres. The solid extract of the drug is recommended, in doses of from 5 to 10 grains, and the fluid extract in doses of from ½ drachm to ½ ounce. R. L. Payne (Med. News, Apr. 2, '92).

Inevitable Abortion.—When abortion cannot be avoided, all the foregoing measures are contra-indicated.

During the first two months but little treatment is necessary other than rest in bed. If no untoward symptoms appear, such as marked hæmorrhage, rise of temperature, etc., expectant measures are sufficient, at least for some days.

During the third month the ovum may be expelled entire,—*i.e.*, without rupture of the membranes. In this case no active measure is required beyond, perhaps, an antiseptic douche,—a creolin 2-per-cent. solution of a weak carbolic-acid one,—employed twice daily.

When, in the course of the third month the sac ruptures and the liquor amnii escapes, the sudden reduction of the pressure exerted by the ovum upon the intra-uterine surfaces causes free hæmorrhages from the utero-placental vessels.

Hæmorrhage. — The treatment of the hæmorrhage at this period is that for the subsequent one. The patient being placed in the Sims position, all clots are removed and the vagina is packed with iodoform gauze or cotton-wool. If the bleeding persist, vaginal douches of hot alum solution, 1 ounce to the pint, are administered. The packing is then renewed, and 3 drachms of the fluid extract of ergot are injected into the rectum. If the bleeding is alarming, the uterine canal may be packed with small pledgets of iodoform cotton or gauze.

Whenever abortion takes place none of the tissues should be left in the uterus. 1. At 4 weeks best to keep down hæmorrhage and to wait for nature to act; if interference necessary, decidua to be removed, using the curette. 2. At 6 to 8 weeks chorion causes most trouble; finger or curette used and strip of iodoform gauze introduced to fundus. 3. At 10 to 12 weeks fœtus comes first; other tissues apt to need artificial removal; finger best; gauze as before; small doses of ergot for twenty-four hours. Edward Ayers (Medical Record, Sept. 28, '95).

When fragments of placenta or other adnexa are left in the uterus they rapidly give rise to foul discharge, which may be followed by grave septic symptoms. The patient should at once be placed in the Sims position and be given an anæsthetic, if necessary. The endometrium is then thoroughly cleansed and curetted, then washed out with hot 1 to 5000 corrosive-sublimate solution. No ergot should be administered until the uterus is thoroughly emptied. The external genitals are then carefully cleansed and a compress of carbolized cotton is applied over the vulva. Lysol, in 1-per-cent. solution, is highly recommended for injections in infectious cases.

When with closed os hæmorrhage is profuse, we must no longer speak of "threatened," but of "beginning," abortion. In cases like this, especially if the os enlarges, we cannot possibly reckon on saving the embryo, although this may unexpectedly occur in rare instances. The third stage is that of complete abor-

tion; persistent bleeding usually denotes retention of bits of membrane, and the proof of retention is usually found in the patency of the os to one finger. Examination of the ovum is necessary to determine the likelihood of the persistency of portions within the uterus. In this way, if we find that the integrity of the expelled ovum has not suffered, we need have no fear of retention. If the ovum is incomplete, and hæmorrhage continues from the uterus, we have every warrant for emptying the uterus with the curette. If the os uteri closes, we may feel sure that the remains of decidua must be slight. With every evidence of expelled ovum and closed os, persistent bleeding can be due only to atony of the uterus. Lantos (Monats. f. Geburts. u. Gynäk., May, '99).

If haste imperative, the cervix is dilated and a lateral incision is made in the cervix. The uterus is then emptied with a blunt, rounded, fenestrated curette, followed by swabbing. The uterus is thus emptied without hæmorrhage. The pain is very slight and no anæsthetic is required. The incision in the cervix is at once sutured. This method is prompt, sure, and safe. Doléris (Semaine Méd., Sept. 5, 1900).

The best method to adopt to incur little risk for the patient: No interference is necessary in ordinary cases except in cases of severe anæmia produced by a profuse hæmorrhage or by long-continued slighter bleeding, when portions of the ovum are retained, and in cases which have become septic. The most rational method of arresting hæmorrhage is to remove the ovum completely. If this has left the body of the uterus, and is retained partially or totally in the cervix or vagina, a speculum should be introduced, and, if the finger cannot easily complete the removal, ovum forceps may be used. When the ovum is still in the body of the uterus, one or two fingers should be introduced, and—while counter-pressure is exercised by the other hand from the abdominal wall—the sac separated completely from the uterine wall. Once it has been separated, it can usually be removed by combined action of the internal finger and expression from without. The whole process can be made more easy if one seizes the anterior lip of the cervix with vulsellum forceps (double-toothed), and administers an anæsthetic. The operator must not be disturbed by the hæmorrhage, but must rely on the fact that this will cease on completion of the abortion. If the cervix is not permeable for the finger, thorough plugging of the uterus, cervix, and vagina with sterile iodoform gauze is then indicated. The cervix is brought into view with a Sims speculum by means of a uterine catheter or sound, and the size of the uterus by bimanual examination, and not by the sound. The vagina is to be thoroughly irrigated, cleansed, and dried, and then the strips of gauze introduced with smooth ovum forceps. All one's efforts should be directed toward keeping the ovum intact. At times it may be necessary to substitute a sound for the forceps in packing the uterus. If the ovum is not cast out after twenty-four hours, the plugging is to be removed, the passage again thoroughly disinfected, and a second packing undertaken. Sellheim (Münchener med. Woch., March 11, 1902).

Delayed Abortion.—When this occurs prolonged expectant treatment exposes the patient to dangerous hæmorrhage and septicæmia; hence early active measures are indicated. If the adnexa are not expelled in twenty-four hours, injections of hot carbolized water into the uterus, between its walls and the ovum, every three hours, using a Bozeman catheter, may be employed; or, if the hæmorrhage is controlled and the os is sufficiently patent, the finger may be introduced, then hooked, and the uterine contents evacuated.

If the os is not dilated, a piece of iodoform gauze or an iodoform bougie can be inserted; in from twelve to twenty-four hours the finger can generally be introduced and the adnexa removed. If this is difficult, a blunt curette may be

employed instead of the finger, preferably Thomas's large model. Sims's sharp curette is also highly recommended. If used with due care it is an excellent instrument.

"When intervention is necessary, instead of the curette I simply use my finger, which is a marvelous instrument for one possessed of intelligence, while the curette is a blind instrument which I only use when there is hæmorrhage or infection." For intra-uterine injections a solution of permanganate of potassium recommended. Tarnier (L'Union Méd. du Can., Nov., '97).

To use the finger as a curette is, in most cases, unsatisfactory, even when one hand is used for pressing the fundus down. The finger is often arrested at the internal os or does not reach the uppermost part of the cavity, and, at all events, it can only be used to separate the ovum from the uterus, and cannot remove the decidua vera. Henry J. Garrigues (Med. News, Nov. 6, '97).

Condition indispensable and invariable for the efficient and thorough use of the curette after abortion, — namely: that the uterine canal should be sufficiently dilated to permit the index finger to explore the uterine cavity to the fundus, in order not only to determine the quantity and location of the retained secundines, but also to enable the operator to be perfectly sure that the cavity has been entirely emptied when the operation is completed.

An empty uterus after abortion almost always contracts, and all hæmorrhage from its cavity ceases. A failure to contract at that time is an exception. If a hot sterilized or carbolized intra-uterine douche is used after emptying an aborting uterus, prompt contraction and cessation of bleeding takes place. Only in women very much exhausted from hæmorrhage might it be advisable to pack the empty uterus after abortion with iodoform gauze, or, better, sterilized gauze, in order to save her even the few drops of blood which would ooze away during the first day or two, until she has rallied. Paul F. Mundé (Med. News, Nov. 27, '97).

Case in which patient had been curetted on two occasions to remove remains of incomplete abortion. At second operation, failing to remove all placental tissue with curette, uterine cavity was plugged, and, after forty-eight hours, finger introduced and remaining portions removed. Severe hæmorrhage led to extirpation of uterus. On microscopical examination, material removed by curette proved presence of muscular tissue. Conclusion that placenta in this case must have been abnormally adherent, and uterine wall abnormally soft, and that the finger is a better instrument than curette in imperfect abortion. Dührssen (Berl. Med. Soc., May, '98).

This treatment, if applied sufficiently early, causes a reduction of temperature. Within an hour or two a chill may indicate slight absorption of infectious elements through the vessels laid open during the operation; but rapid improvement usually follows.

When the curette is used the softened condition of the uterine tissue should be borne in mind; death from perforation has been reported. (Alberti, Long, Haynes.)

Many accidents have been attributed to the curette. Récamier reported three cases from perforation of the uterus by his curette; Dumarquay two; Chamberlain had a case of hysterical tetanus; Peaslee, a death from collapse; Thomas, a narrow escape from the same cause; and Parker, a case of peritonitis. But in these cases it was not the Sims sharp curette. It should, of course, be handled with ordinary common-sense in order not to cut too deeply and, perhaps, perforate the uterine wall. Personally used in a large number of cases without accident. Goldberg (Buffalo Med. Jour., Aug., '97).

In 99 cases (out of 275) requiring operative interference, 55 were treated by digital exploration and removal of fragments, and 44 cases were treated by curetting. In this series of cases 6 deaths occurred. In 2 cases, at the autopsy, a perforation was found at the fundus

uteri, with peritonitis. Both cases were already infected before reaching the hospital. In 1 curettage had been carefully performed; in the other the uterus had merely been packed with gauze. The third fatal result was due to suppurative salpingitis, operated upon after leaving the hospital. The 3 remaining deaths were due to infection, the patients arriving at the hospital with grave septic symptoms. Maygrier (L'Obstétrique, July, '97).

Antiseptic douches are important to remove what *detritus* may remain behind a 3-per-cent. carbolic-acid solution from the endometrium after curetting.

Packing of the uterine cavity with iodoform gauze after curetting is not a safe procedure; it has caused peritonitis.

The too copious use of corrosive-sublimate solution for injection has caused death. If the cervix will not yield to simple measures, Hegar's, Ellinger's, or Barnes's dilator may be used.

New method of treating incomplete abortion: With Bozeman's intra-uterine douche, a hot creolin solution is allowed to flow, always watching to see that the return-current remains free. All loose clots and *débris* are removed by the dull curette. The cavity is again washed, until nothing remains but the firm decidual tissue (which clings to the uterine wall) and the creolin solution returns white. Finally the uterus is packed from the fundus to the external os with iodoform gauze. The first gauze is withdrawn, thereby wiping out the cavity, and a second piece is firmly placed so as to stop all hæmorrhage. No opiate is allowed.

As a result of this procedure the inert uterus is stimulated to contract. The blood, unable to escape, distends the cavity and flows in between the decidua and the uterine wall, dislodging the former. Finally, the internal os dilates, the gauze is expelled, and all the uterine cavity with it. Another creolin intra-uterine douche is then given, and, if endometritis exist, the gentle use of the sharp curette and a gauze drain complete the work. Contraction and involution of the uterus go on rapidly. Three illustrative cases. Anna M. Stuart (N. Y. Med. Jour., Sept. 6, '96).

The following procedure recommended in incomplete abortion: Under chloroform cervical canal is dilated with, first, index finger and then middle finger. Uterus is fixed with hand acting through abdominal wall. Then, with two fingers or one, interior of uterus is thoroughly scraped. To evacuate uterus it is sometimes sufficient to make traction on placental fragments with fingers or with one finger hooked. Usually it is necessary to employ uterine expression, done by placing two fingers in posterior vaginal fornix and pressing them forward, while with other hand placed on hypogastrium pressure is made on anterior fundus uteri. Uterine cavity is then washed out, and mixture of glycerin and creasote applied. Only when there is any hæmorrhage and the uterus does not retract properly it is necessary to plug utero-vaginal canal with iodoform gauze. P. Budin (Progrès Méd., Sept. 17, '98).

Treatment of abortion based upon 100 cases met with in four years. Vaginal plug usually quite useless. If removal of the ovum is indicated, the manual method is always preferable. Expression fatigues the patient very little, and is indicated when the os has a diameter of about four centimetres, and when the ovum is, in great part, detached and in the cervical canal. In 15 cases this plan was followed, and in 12 the ovum was thus delivered, but in 3 only pieces came away, and the rest had to be removed by the finger. If expression fail, two fingers are to be introduced into the uterus, and the ovum or parts of it at once taken away. In abortion, just as in labor, everything should be removed at once. The finger is generally to be preferred to the curette. The use of all kinds of ovum forceps condemned. Ninety-nine women recovered fully. Drejer (Norsk Mag. for Laegevidensk., No. 3, Mar., '99).

Expectant treatment, antisepsis being the only measure resorted to, is preferred by some (Varnier and Pinard), active procedures being only resorted to in cases of serious hæmorrhage or infection.

Study of 4333 cases in Tauffer's clinic tending to demonstrate that even retained membranes should only be removed when decided indications are present. Velits (Int. klin. Rund., Mar. 8, '91).

In cases of retention of the placenta after abortion the practice of Tarnier is as follows: 1. Antiseptic preliminary injections either of permanganate of potash, 1 to 2000, or of carbolic-acid water, 20 to 1000, with iodoform or salol dressings to the vulva. 2. In case there is danger of infection through putrefaction of the placenta, recourse should be had to digital and antiseptic curettage after dilatation. 3. When the physician is called after septicæmia has become generalized, or when the symptoms of infection are very pronounced, it becomes necessary, considering the imminence of the danger, to resort to curettage of the uterine cavity, using, at the same time, all antiseptic precautions. Quinine, in large doses, has recently been recommended.

The expectant treatment of abortion is to be preferred. Packing of the uterus and vagina recommended. Of 292 cases observed only 1 ended fatally. This patient was already infected and suffering from high fever. Curetting and local treatment were unsuccessful.

It is best to leave, as long as possible, the expulsion of the ovum to the natural forces, which in many cases of abortion are better able to do it than our hands and instruments. When some special danger exists for the mother, however, or when the termination of the abortion may easily be accomplished, interference is permissible.

The fear of packing, which until recently was prevalent, has disappeared, for, with due precaution, it is without danger. There is not so much danger of infection with it as with manual and instrumental procedures. P. Müller (Volkmann's Samml. Klin. Vort., No. 153, Apr., '96).

Case of severe post-partum infection in which, notwithstanding active measures, the patient seemed to be becoming moribund. Twenty ounces of sterilized saline solution injected into the cellular tissue at first. Improvement of the symptoms followed at once. The injections were continued twice daily for six days. Diuresis and a fall in the pulse-rate were marked throughout, the intestinal irritation stopped, and the temperature became normal. The patient made a perfect recovery. Ostermayer (Centralb. f. Gynäk., Mar. 12, '99).

Electricity may be used as a substitute for the curette in incomplete abortion. For the immediate removal of retained secundines the faradic current is employed, but, for the removal of these after retention for some time, the galvanic is preferable.

Two hundred and seven cases personally treated with curette. Sequelæ were met with in only 34.4 per cent. compared with 92.4 in those in which it was not employed. In the former, the menses were regularly re-established in 60 per cent., pregnancy to term supervened in 53 per cent., abortion recurred in only 13 per cent., and sterility prevailed in 32.3 per cent. When the curette was not used and fingers were, regular menstruation in 39.4 per cent., pregnancy to term also in 39.4, repeated abortion in 47.3, and sterility in 25.1. The cases were all treated upon the same general principles, and the curette was only employed in the presence of the strongest indications. Schaeffer (Deut. Prax., Nos. 1-3 and 5-8, 1901).

Streptococcic serum in the septicæmia of abortion has been used with apparent success.

Method of dealing with an infection after an abortion. The cavity of the uterus is first cleaned out to prevent the continued absorption of toxins from any infectious material which may be present, and thus, at least, limit the intensity of the process. For this the finger alone is employed, or combined with the curette. The cavity of the uterus is washed out with hot saline and 2 ounces of peroxide of hydrogen; it is

then cleansed with saline solution and sponged dry. After this 2 or 3 drachms of iodoform powder are placed in the uterine cavity, which is then packed with sterile gauze. Now the *cul-de-sac* is freely opened, and, after evacuating any fluid which may be present, it is irrigated with hot saline, followed by 2 ounces of peroxide of hydrogen. This in turn is washed out and the cavity wiped dry. Last, 2 or 3 drachms of sterilized iodoform powder are dusted into the *cul-de-sac*, after which it is packed tightly with strips of sterile gauze.

By this procedure the author believes that two advantages are obtained: (1) by evacuating the fluid from the *cul-de-sac* further absorption is prevented; (2) the ovaries and Fallopian tubes are saved by preventing adhesions which would almost invariably form as a result of the organization of the exudate. Personal experience has shown that the secretions from the uterine cavity are almost always sterile, while organisms are invariably found in the exudate in the *cul-de-sac*. Hunter Robb (Amer. Gyn., June, 1903).

Exhaustion from Hæmorrhage.—This condition may be treated by rectal injections of 1 or 2 quarts of cool saline solution, or careful injection of hot (120° F.) saline solution into the femoral artery (middle of Poupart's ligament), using a large hypodermic needle connected with a Davidson syringe. Subcutaneous and rectal saline injections may be given simultaneously, if need be. Hypodermic injections of $^1/_{60}$ grain of strychnine enhance the action of injections.

Habitual Abortion. — *Etiology.* — Habitual abortion may be due to either constitutional or local causes. Of the former the principal are syphilis, lead poisoning, tobacco poisoning, and heart disease.

The local causes are divided into four groups: Malformations of the uterus, displacements of the uterus, active congestion of the uterus and especially of the cervix, and diseases of the cervix or body of the uterus.

Malformations. — In these cases the uterus has preserved some of the characters of the infantile uterus, the body being disproportionately small or the cervix disproportionately large. Distension of the uterus by the growing ovum causes severe attacks of uterine colic and sympathetic disturbances, which commence during the second month, and usually lead to abortion about the third or fourth month. These cases are not common, because fecundation is rare in the malformed uterus.

Displacements.—Flexions are of more importance in this connection than either versions or prolapse. In ante- or retro- flexions there is a thickening of the uterine tissue at the angle of flexion, which interferes seriously with the progress of pregnancy, and leads to repeated abortion at the third or fourth month.

Congestions.—In the case of women who habitually lose freely at the monthly periods it is not uncommon to find that during pregnancy they have a periodic loss of blood, accompanied by pain, especially during the latter months. In plethoric women these hæmorrhages during pregnancy are beneficial, and should not be arrested.

Diseases of the Uterus.—Endometritis, new growths of the body of the uterus, and extensive erosion of the cervix usually lead to abortion. (Charpentier.)

Treatment. — The causes should be sought after and any existing affection removed, if possible. Syphilis especially requires prolonged and curative treatment. In congestion of the uterus Carpentier recommends wet cupping of the loins to relieve the engorgement, and thus enable the uterus to retain the ovum. Any special irritability of the genital organs that may exist should be

treated by rest in bed for some days at the menstrual period during pregnancy.

Viburnum prunifolium, $^1/_2$ to 1 drachm of the fluid extract twice daily, or asafœtida, 1 grain in pill three times daily, as soon as pregnancy is suspected, and gradually increased, are frequently recommended. Chlorate of potassium, 15 to 30 grains daily, is valuable in this connection, but is more likely to disturb the stomach.

A large number of drugs possess more or less marked powers as abortifacients and hence should be avoided during pregnancy. Quinine, cantharides, pilocarpine, strychnine, erigeron, elaterium, jalap, podophyllin, aloes, senna, scammony, and violent purgatives in general, especially those likely to cause engorgement of the hæmorrhoidal vessels, are the most pernicious agents in this particular that are in general use as remedies for other conditions.

Although quinine appears to have but little oxytocic action in some, in others it excites uterine contractions, especially in delicate, nervous, and anæmic women; it should not be given in large doses unless with some narcotic that will act as sedative upon the uterus. (Coromilas.)

To replace quinine, when indicated for malaria, phenocoll, which, while efficient for malaria, has no action on the uterus; 22 grains divided in four cachets given five, four, three, and two hours before febrile paroxysm. Titone (Brit. Med. Jour., Mar. 23, '95).

Cases of so-called habitual abortion, which so commonly depends on a diseased state of the endometrium, may be overcome by a two minutes' steaming at 212° F., followed, for six or eight days, with applications of tincture of iodine.

Results in ten cases: In five the fever disappeared speedily by crisis, in two lysis occurred, and in three there was no notable fever to begin with. The occurrence of lysis indicates infection of a moderate grade. In almost all cases the odor ceased at once or became so slight as to be hardly noticeable. Pincus (N. Y. Med. Jour., Mar. 20, '97).

In cases in which women who are usually regular pass over a period, as well as in habitual abortion, exhibition of 5 to 8 grains of acetanilid, repeated in one, two, or four hours as necessary, advocated. In cases of ovarian irritation, where there seems to be tendency to separation of ovum at what would have been a menstrual period, more or less regular use of viburnum prunifolium and potassium bromide, with acetanilid at time of each periodic disturbance, recommended. In emergency cases acetanilid 10 to 15 grains, repeated at short intervals, should be given, but in every instance individual susceptibility should be considered. Harnsberger (Jour. Amer. Med. Assoc., Oct. 22, '98).

Twenty-one cases of abortion and premature labor, with death of the embryo or fœtus. These were treated by prolonged rest in bed, and by the administration of iodide of potassium and iron throughout the entire pregnancy. The author's cases may be divided into three classes: one, syphilitic, in which the syphilis was old or hereditary; the second class, in which the kidneys were very deficient in action and the patient was threatened with nephritis; and the third class, in which the patient was constantly absorbing necrotic material from a chronic endometritis. He believes that the treatment acts by preventing the rupture of vessels in the placenta. Stress is also laid upon the chronic anæmia present in these cases, for which the author uses iron. Lomer (Zeits. f. Geb. u. Gynäk., Bd. xlvi, H. 2, 1901).

Potassium chlorate recommended in habitual abortion. As soon as the patient is pregnant 3-grain doses of potassium chlorate are given. This is continued during the entire period of gestation, decreasing the daily dose of the drug in the last weeks to $2^1/_2$ grains. No untoward effect has been observed, either on the mother or the child, from this treatment. The pregnancy was brought to normal completion in a number of women who previously had noth-

ing but miscarriages. S. Remy (Semaine Médicale, xxii, No. 39, 1902).

MISSED ABORTION. — The embryo sometimes dies as a result of the conditions giving rise to abortion, and remains in the uterine cavity,—the so-called "missed abortion." The active symptoms of miscarriage may be present; or the patient may only ascertain by the cessation of all fœtal motion that it is no longer living. The fœtus may entirely disappear, or become transformed into a shrunken remnant. They are most frequently expelled within six months, but sometimes remain in the uterus as long as eleven months. The usual symptoms of premature delivery are gone through. In its altered condition, the product is variously termed "fleshy mole," "blighted ovum," or "apoplectic ovum." The occurrence of this complication is comparatively rare. It may repeatedly occur in the same woman.

Case of missed abortion in which the embryo perished during the second month of pregnancy, and was retained until the tenth month. I. Kobro (Norsk Mag. f. Läg., 4 R., X 12, S. 1110, '95).

The first factor is the death of the fœtus; this is followed by shrinking of the chorionic sac and blood-extravasation among the villi. As a result, numerous small, rounded protrusions are to be seen when the interior of the sac is examined,—the so-called "subchorionic hæmatomata," "tuberous subchorionic hæmatomata," or the "tuberculous ova" of Granville. They are considered by some observers as malignant.

When the fœtal circulation ceases, the vessels of the placenta are rapidly obliterated. The fœtal epithelium covering the chorion and its villi degenerate, and the maternal blood between the villi forms clots, which are altered into dense laminated fibrin. The decidual cells then multiply and invade the fibrin, which they gradually replace, filling the intervillous space with layers and bands of decidual tissue. At the same time they disintegrate the fœtal epithelium, which comes to be represented by scattered heaps and rows of nuclei, and finally disappears. The amnion remains almost unaltered, but adheres closely to the chorion, and the united membranes are thrown into folds and convolutions, covering the rounded lobes of altered placental tissue. The fœtal portion of the placenta does not grow after the death of the fœtus, though the maternal portion containing the decidual cells remains active. It is therefore improbable that malignant new growths can arise from fœtal placental elements. W. E. Fothergill (Brit. Med. Jour., Mar. 20, '97).

The fleshy mole is undoubtedly a form of the process known as "abortion," but the obstetrician should remember that the pathological changes which produce it may occur at very different stages of pregnancy. The precise time at which the arrest of normal pregnancy occurs cannot always be determined by examination of a fleshy mole. Neumann (Monats. f. Geburt. u. Gyn., Feb., '97).

In tuberose fleshy mole abortion is produced in the following manner: There is an undue blocking of the serotinal sinuses in the large-celled layer, leading to a slow engorgement of the intervillous circulation. This will bulge out the chorio-basal septa, and, as these tack down the chorion at definite points, the amnion and chorion will bulge up between. This produces the tuberose swellings. The embryo dies as the result of this interference with the circulation, and its death is "secondary." The placenta becomes a thrombosed mass and is retained a certain time before expulsion. The primary link in the chain of events is the excessive clotting in the serotinal sinuses from a cause as yet unknown. D. Berry Hart (Jour. of Obstet. and Gynæc. Brit. Empire, May, 1902).

The first symptom is usually a bloody discharge, which is frequently taken for the return of menstruation. The uterus

is found to be enlarged according, of course, to the size of the fœtus, and the internal os generally permits of the introduction of a finger-tip. The presence of the ovum, or fœtus, may therefore be ascertained in a proportion of cases, but when this is impossible the diagnosis is established with difficulty. The discharges generally become very fœtid, however, and suggest, by the character of the odor emitted, the nature of the body present.

Treatment. — Removal of the dead fœtus is the only course to be pursued. The means are precisely those for the removal of the placenta just described, the strictest antisepsis being observed.

Induced Abortion. — It is seldom necessary to induce abortion during the earlier months of pregnancy, as the disorders occasionally rendering this step obligatory are frequently amenable to other measures. The most important conditions that may necessitate this step are incoercible vomiting, heart disease threatening life, and serious hydramnios.

Many drugs—such as saffron, tansy, wormwood, cinnamon, horehound, etc. —generally considered as capable of provoking expulsion of the fœtus, are practically without effect, while more powerful agents—such as rue (*Ruta graveolens*), savin, red cedar, *Arbor vitæ*, and yew—are only active when giving rise simultaneously to dangerous general symptoms. In women predisposed to abortion, however, all these drugs, besides others previously mentioned, are capable of exciting expulsive contractions of the uterus.

The means for the purpose are, briefly, catheterization of the uterus, injections between the uterus and ovum, mechanical dilatation of the cervix, the vaginal tampon or douche, and electricity.

It is important to bear in mind, in this connection, that a physician should never perform abortion without one or more consultants.

> A new method of producing abortion: A curved silver catheter, 2 millimetres in diameter, is passed to the fundus uteri. A syringe, with a capacity of about 4 grammes, is attached to the catheter, and by it 3 grammes of tincture of iodine are injected into the uterine cavity. The catheter is now removed, and a tampon placed against the cervix to prevent the iodine from coming in contact with the vagina. This method is uniformly successful and quite free from danger. The abortion occurs within two or three days. The iodine penetrates and destroys the embryo, while its antiseptic properties are a safeguard against sepsis. Oelschläger (Edinburgh Med. Jour.; from Centralb. f. Gynäk., No. 27, 1901).
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> The electric current is a safe means when artificial abortion is necessary. The patient is placed on a table or gynæcological chair, the external genitals and the vagina are washed with a solution of formalin or lysol and soap, the cervix exposed by a speculum, and the canal cleansed by means of pledgets of cotton saturated in a 2-per-cent. solution of lysol. Apostoli's bipolar electrode is then introduced in such a manner that the platinum end of the second attachment is seen around the external os. A constant current is applied and gradually increased from 50 to 75 and even 100 milliampères, for fifteen minutes. At the end of this time the electrode is removed and the cervix and vaginal portion of the uterus swabbed with a 2-per-cent. solution of lysol. Three applications are usually sufficient to insure success. M. M. Mironoff (Phila. Med. Jour.; from Jour. Akouscherstwa i Zshenskick Boleznei, No. 12, 1901).

Criminal Abortion.—In all civilized countries most severe punishment is inflicted upon criminal abortionists; in most of them the penalties are increased if the crime is committed by professional persons, such as medical men, midwives,

and druggists. Notwithstanding this, criminal abortion is extremely frequent, principally in large cities.

It is generally between the second and fifth month of pregnancy that abortion is artificially produced.

Criminal abortion is performed by means of drugs and by local and surgical intervention. A large number of drugs were, until recently, thought to possess active ecbolic properties, but a more elaborate study of the question has shown that no drug has a special action upon the uterus for expelling the product of conception.

Criminal abortion is sometimes brought on by using lead. Four cases in which it was definitely determined that lead was taken for this purpose, and in which a diagnosis was made by discovering a blue line on the gums. Fourteen similar instances known of, some of which were personally seen, others having occurred in the practices of colleagues. As a rule, the diagnosis in these cases was at first acute gastritis, renal colic, tubal inflammation, and similar conditions. In many cases the patients misrepresented matters absolutely, and there was not the least suggestion in their story of the actual cause of their condition. Schwarzwaeller (Berliner klin. Woch., Feb. 18, 1901).

The only fact to be admitted in a medico-legal point of view is that some drugs may cause abortion in predisposed women, but more by the general disturbance of the system than by any specific action on the womb. The strong cathartics (scammony, jalap, etc.), given in large doses, may be classed in this category. Caustic acids are also active in the same sense.

Examination of 72 women on whom criminal abortion had been performed. In 1 case death resulted from nervous shock.

In 5 other cases, during or shortly after the injection, faintness, dizziness, and vomiting occurred, lasting several hours and disappearing without leaving any trace. In nine-tenths of the cases there was no special disturbance. Abortion usually resulted in the course of a day, sometimes in six or eight hours. In only 4 of 5 cases was fever present or the patients obliged to remain in bed for several days. In 25 cases, however, there was evident endometritis, which proportion would show some relation to the operation. It was strange that no septic troubles arose, as no special care was taken either of the syringe or the solution used. Vibert (Jour. de Méd., Feb. 26, '93).

Case of criminal abortion by the use of a tupelo tent in which the latter had been forced through the uterine walls. The tent was found lying transversely in Douglas's *cul-de-sac*. Supravaginal hysterectomy performed, on account of the septic condition of the pelvic cavity. The perforation, beginning at the internal os, extended obliquely upward and the tent had been forced through the serous coat just below the left horn of the uterus. W. Easterly Ashton (Med. Bull., July, '97).

Opinion recorded as to liability of person who consents to have abortion performed upon her: The judge, when summing up in the Collins trial, decided that "the woman who submits herself to an unlawful operation is guilty of felony just as much as the agent she employs." Editorial (Ga. Jour. of Med. and Surg., Sept., '98).

Death may ensue without the production of traumatism, during the intrauterine use of instruments, probably through the intermediary of the sympathetic system.

Case of sudden death during attempted abortion while introducing the nozzle of a syringe into the os uteri. Judicial inquiry. No uterine abnormality found, although the cervix was soft and patulous. Death seemed to be due simply to syncope from a stimulus arising in the uterus. It was a phenomenon of inhibition. Syncope has been observed after passage of the sound. De la Touche (Sem. Gynéc., June 23, '96).

In performing an autopsy upon a woman who is supposed to have attempted abortion search should be made for the embryo or pieces of it, or for the placenta. If the uterus is empty, the thickness of its walls must be measured, and the insertion of the placenta sought, as this can be recognized up to the tenth day after the expulsion of the embryo. This is possible even later, if the uterus is kept in 90-per-cent. alcohol. The examination of the ovaries is of only relative importance, as no positive signs exist there. Stains of meconium, if found, will prove the abortion. If an instrument has been used to cause abortion, traces of the damage done by it will be seen. This is especially true when the uterus has been perforated. Brouardel (Jour. des Praticiens, Jan. 12, 1901).

Six hundred and ninety-eight cases of abortion witnessed, supposed to be spontaneous. Four of the women died: that is, 0.57 per cent. During the same period forty-four cases of criminal abortion were treated: the mortality was 56.8 per cent.: that is, only nineteen women recovered. In the presence of a complete or incomplete abortion, due unmistakably to mechanical measures, or even when such abortive measures are suspected, and in absence of any complication, early evacuation of the uterus is required. If septic accidents have already developed, evacuation is still more urgent, and general measures are also indicated. Maygrier (L'Obstétrique, July 4, 1902).

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ABSCESS. — Lat., *abscessus*, from *abscedere*, to depart.

Definition.—A collection of pus in an adventitious cavity, the result of an acute, circumscribed inflammation due to infection with pus-forming microbes.

Varieties.—An abscess may be *acute*, or *warm*, when due to pus-microbes only: staphylococci, streptococci, and others; *chronic*, or *cold*, when due to a specific microbe, especially that of tuberculosis.

Abscesses have been classified according to:—

1. *Etiology.*—Atheromatous, embolic, fæcal (stercoraceous), lymphatic, metastatic, miliary, ossifluent, puerperal, pyæmic; residual symptomatic, or congestive; tropical, tubercular (strumous, or scrofulous), etc.

2. *Pathology.*—Acute, or warm; canalicular; caseous; chronic, or cold; critical, diffuse, gangrenous (anthrax), ligneous, perforating, phlegmonous, etc.

3. *Location (Organ or Tissue Involved).*—Alveolar (gum, jaw, teeth), of antrum, of axilla, bone (subperiosteal), brain (cerebral, cerebellar), bursal, corneal (hypopyon), deep, dorsal, follicular, hepatic, of hip-joint, iliac, ischio-rectal, lacunar, lumbar, mammary (milk; weid, or weed; breast), marginal, mediastinal, meningeal (extradural, subdural), of middle ear, of neck, nephritic and perinephritic, of nose, of palate, palmar, of pancreas, pectoral (empyema), perityphlitic, popliteal, of prostate, psoas, rectal, retropharyngeal, of skin (furunculosis), of scalp, of space of Retzius (properitoneal cavity); spinal, or vertebral; of spleen, superficial, thecal, urethral and periurethal, vulvo-vaginal (Bartholinian), etc. All the above varieties will be considered under their respective anatomical heads.

Acute, or Warm.

Symptoms.—An abscess may either be superficial or deep. When it is superficial the local symptoms predominate; when it is deep the general symptoms are generally the most marked.

The pain, due to compression of the nerves by the disturbed tissues, varies in degree with the density of the parts involved, the local supply of sensitive nerves, and the tension produced by the inflammatory products. In superficial abscess the pain is generally localized in

the centre of the swelling, and is sharp and lancinating; in deep abscess it is more diffuse and dull.

Redness is due to engorgement of the local blood-supply, and the swelling to the inordinate distension of the vessels and the secondary escape of blood-plasma, colorless corpuscles, etc., into surrounding tissues. It may become very great in regions such as the lids, the lips, etc., in which the cellular tissue is lax. As the purulent foci run together and form a single cavity, the centre of the tumefaction becomes soft, and darker in color, and the abscess is said to be "pointing."

Œdematous infiltration in superficial abscess denotes the presence of pus; in deep abscess subcellular œdematous infiltration is an important sign of deep suppuration.

Local heat, throbbing, and tension are mechanical results of the causes of tumefaction tending to decrease as the formation of pus progresses.

Hyperpyrexia is in relation with the location of the abscess, the ease with which the pus-microbes can enter the circulation, and the amount of pus and necrotic tissues present. In superficial abscess there is but little rise of temperature, but in deep abscesses it sometimes reaches 104° F. (40° C.) at the time the wall of granulation tissue is established. A remission of about one degree each morning usually takes place. When the pus has found an issue, or has become completely surrounded by the limiting membrane, the intensity of the fever is usually reduced.

In a superficial abscess, if a chill occur, it is usually very slight, and appears between the fourth and the eighth day. It indicates the formation of pus. In a deep abscess a chill generally occurs, lasting from a few moments to half an hour.

Fluctuation is generally obtained when the purulent focus has been formed. A sharp localized pain, on pressure over the apex of the swelling, obtained at this time supports the likelihood that pus is present, but fluctuation is liable to be a misleading symptom.

Interference with motion or the normal functions of a part is sometimes produced through the proximity of the abscess.

Etiology.—Inflammation due to traumatisms and lesions of all kinds, especially the introduction of foreign bodies under the epidermis, are the usual causes of abscess. While blows do not apparently produce superficial lesions in the majority of cases, the fact remains that an invisible abrasion may be present and serve as a channel for the introduction of the pyogenic organism. The cutaneous glands, through weakened local resistance, may also become the transmitting media. Any cause removing the epithelial layer of the mucous membrane may also form the primary etiological factor of an abscess in the membrane or in the submucous connective tissue. Abscesses also arise in connection with the various septic fevers.

Suppuration can occur in man without the presence of bacteria. Both in animals and in man suppuration may be due to the irritation of chemicals. Investigators have shown that suppuration is only a certain stage of inflammation, not a separate qualitative form of inflammation. The serous formation of blebs and bullæ becomes purulent without the presence of bacteria. Karl Kreibich (Wiener klin. Woch., June 13, 1901).

Case of subcutaneous abscesses due to the gonococcus in a child 2 years of age. The little patient suffered from typhoid fever, and a few days after admission to the hospital developed an acute anterior urethritis, which was proven to be gonorrhœal in nature.

The source of infection could not be established. Seven and ten days later, respectively, areas of induration appeared to the left and right of the anus. Both were found to contain pus in which gonococci were present. Gershel (Med. Record, Feb. 7, 1903).

Pathology.—While several varieties of micro-organisms are found in the pus of an acute abscess, staphylococci and streptococci are by far those most frequently observed, the former being usually found in circumscribed abscess and the latter in diffuse ones. The first step in the process is increased rapidity of the flow of blood in the part, the vessels becoming engorged and dilated. This is succeeded by slowing of the current and passage through the vascular walls and into the surrounding tissues of colorless corpuscles (leucocytes), a few red corpuscles, and blood-plasma, the latter of which become coagulated and finally softened. One or several cavities are thus formed; but, if the cavities are multiple, the barriers usually soften and a single focus is established. The pus is composed of the corpuscles which perish in the cavity thus formed, the broken-down remains of tissue, and the plasma. At a distance from the location of the abscess the circulation is normal, but, as the diseased area is approached, the slowing of the blood-current becomes gradually more evident, until a zone of living leucocytes is met, forming a protective barrier around the abscess-cavity. The surrounding parts also become permeated with new vessels, and a zone of granulation tissue (the pyogenic membrane of older writers) is formed. The spread of the suppuration being thus checked, the pus is forced to the surface because it finds the least resistance in that direction; but, if an aponeurosis or fascia interfere, it burrows until an exit is found.

The rôle of the white corpuscles (leucocytes) has been interpreted in various ways; Cohnheim considered them as elements of repair; others have attributed to them the rôle of scavengers. The prevailing theory at present, however, is that of Metschnikoff, who considers them able to attack and destroy invading organisms. The process is termed by him *phagocytosis*, the cells being called phagocytes (φαγω, to eat, and κυτος, a cell).

The dead leucocytes in pus must be looked upon as the cells that have been brought up rapidly to interfere with the spread or diffusion of the products of the micro-organisms; a large number of these cells coming in contact with the poison in a concentrated form may succumb to its action; but before doing so they are able to deal with a certain quantity of the poisonous material, breaking it down and rendering it inert. Other cells are constantly being brought up to assist these, until, at length, the bacteria are completely hemmed in. They live for a short time on the dead tissues; but, being localized by the barrier of leucocytes, they ultimately die, either from inanition or because they are poisoned by their own products. It is found very frequently on opening an abscess that no organisms can be seen, those that were originally present appearing to have undergone degenerative changes and to have been taken up by the phagocytes, or devouring cells. (Sims Woodhead.)

Differential Diagnosis. — Fluctuation only indicating the presence of fluid, the presence of this sign without the other symptoms mentioned should inspire great circumspection, especially if surgical measures are to be resorted to.

Aneurism is the most dangerous condition to fear. Its less acute history, and the thrill and its expansile pulsation, can

only exist in close proximity to a large vessel.

Certain SEMISOLID GROWTHS may simulate an abscess. When the possibility of an aneurism has been eliminated, a fine trocar or exploring needle, if carefully used, will determine the diagnosis.

Prognosis. — This depends upon the general health of the patient. In the robust a suppurative process usually reaches the stage of resolution without giving rise to complications. In individuals weakened by disease, hereditary or acquired, an abscess may be protracted and exhaustive, and diffusion is more likely to occur if resisting tissues interfere with the superficial evacuation of the pus. Deep abscesses are especially prone to become protracted through this cause, the resistance of muscular aponeuroses, etc., forcing the pus into the cellular interstices. Fistulous tracts, or large suppurative areas, are thus created, and the patient may succumb to blood poisoning or asthenia.

Treatment.—*General Measures.*—Rest and elevation of the affected region, if possible; salines, if purgation is necessary. Easily assimilable food, but not low diet; avoidance of stimulating beverages, alcohol, coffee, etc.

Internal Remedies.—If the case is seen early the suppuration can sometimes be arrested by the use of one of the following agents, supplemented by one of the local applications: Tincture of aconite, 1 to 3 drops every hour, closely watching the patient's pulse; tincture of veratrum viride, 1 drop every hour until the pulse becomes slower, the skin moist, and slight nausea is experienced. Calcium sulphide (sulphurated lime), $^1/_{10}$ grain every hour; or

℞ Sulphate of quinine, 1 grain.
Ext. of nux vomica, $^1/_4$ grain.

For one pill; to be taken every three hours.

External Remedies. — The surface is carefully cleansed with antiseptic soap and sprayed with a 2-per-cent. carbolic-acid solution, or with hydrogen peroxide, every two hours, the atomizer being used for ten minutes at each sitting. (Verneuil.)

Compresses dipped in hot 1 to 4000 corrosive-sublimate solution are very effective.

If the abscess is located upon an extremity, a 1 to 4000 corrosive-sublimate solution may be employed in the form of a bath for the limb, the latter being left in the solution several hours at a time.

A solution of nitrate of silver (30 grains to the ounce) may be applied frequently with a camel's-hair pencil.

Tincture of iodine may be applied in the same manner every three hours.

When the surface becomes very tender, belladonna ointment may be rubbed in every two hours.

In abscesses characterized by very severe pain a 10-per-cent. solution of cocaine may be introduced by cataphoresis, the anode sponge of a galvanic battery being applied to the part. The sittings should last five minutes, and be repeated every three hours, the current not exceeding 5 milliampères. During the intervals warm fomentations—with borated, camphorated, or pure water—are of great value.

> Pads of gauze wrung out of hot boric-acid solution (an ounce to a quart of water), applied as hot as the patient can bear them, and well covered with oiled silk to keep in the heat and moisture, are the best; wherever applicable, as with the hands or feet, the inflamed part should preferably be submerged every hour for a period of five to ten minutes

in the hot, boric solution itself. James Stuart (N. Y. Med. Jour., Jan. 16, '97).

Surgical Measures. — If suppuration cannot be avoided, the abscess should be opened as soon as an adequate quantity of pus has formed to constitute an abscess sufficient in size to be recognized by the surgeon as such (Senn), or as soon as the presence of pus has been determined by the exploring needle or syringe.

If a local anæsthetic is necessary, one of the following may be used: Twenty drops of a 1- to 5-per-cent. solution of cocaine introduced subcutaneously near the abscess; ether sprayed over the seat of the abscess until local numbness is experienced; chloride-of-methyl or chloride-of-ethyl vapor. The latter is especially efficacious; the parts turn white when ready,—generally in about two minutes. Seltzer water spurted over the surface may be used to advantage when none of the other agents can be obtained.

To open an ordinary abscess a single small incision suffices; but, if it is large, several small incisions should be made to render perfect evacuation of its contents possible by drainage. If the abscess is superficial, the skin alone should be cut, but if it is deep seated the skin and fascia should be incised and the grooved director, or the points of a pair of forceps, used to reach the pus, the opening being kept patent with forceps. The cavity is then thoroughly emptied and syringed out with 1 to 4000 corrosive-sublimate solution until the fluid comes out perfectly clear. Pressure with the fingers is to be avoided. The incision and its surroundings are then carefully washed with the same solution, and an aseptic drainage-tube inserted. The wound is dusted with iodoform or dermatol, and an antiseptic dressing is applied, exerting slight pressure with bandage. If the abscess is deep, the drainage-tube should be shortened daily; if it is superficial, the drainage-tube can be withdrawn the second or third day.

Thirty-two cases of abscess treated by the Otis method: The skin about the affected area is scrubbed with green soap and washed with sulphuric ether and then with bichloride (1 to 1000). A narrow bistoury is then inserted into the abscess-cavity, and the contents gently, but thoroughly, squeezed out; the cavity is irrigated with bichloride (1 to 1000) and immediately filled to moderate distension with warm iodoform ointment (10-per-cent. iodoform and vaselin), care being taken not to use a sufficient degree of heat to liberate free iodine. An ordinary glass gonorrhœal syringe is used, the plunger being removed, and the barrel warmed in the flame of an alcohol-lamp and filled with ointment by means of a spatula. On finishing the injection, at the instant of withdrawing the syringe from the wound, a compress wet with cold, bichloride solution is applied, which instantly solidifies the ointment at the orifice, preventing the escape of that into the abscess-cavity. A large compress of sterilized gauze is then applied by means of a firm spica. The patient is told to return in four days, when, if all is well, the dressing is reapplied; but, if any evidence of inflammatory action is found the wound is thoroughly irrigated and cleansed and the injection repeated. It is simple and safe; the patient is not prevented from going about. It leaves no scar. Edwin M. Hasbrouck (N. Y. Med. Jour., June 13, '96).

To prevent stitch abscesses cleanse the skin in the usual way with soap and water, and rub into the skin of the operative field hydrated lanolin-oleate of mercury (20 per cent.). A piece of lint smeared with the ointment covers the skin until the second inunction, twelve hours later; the lint is then reapplied until the time of operation, when the superfluous ointment is rubbed off with sterile gauze. A. E. Maylard (Annals of Surgery, Jan., 1902).

Treatment of acute abscess by passive

congestion has given excellent results. Cases of purulent arthritis, suppuration of tendon sheaths, and acute abscesses and carbuncles have shown without exception almost immediate relief of pain and reduction of inflammation. The abscess either became "cold,' or its contents changed to serum or were resorbed. Purulent arthritis was treated with passive motion after all pain had been relieved. The writer selected 15 of the 110 cases cited for brief description in the article. All cases were quickly cured, and it was only rarely necessary to open the abscess. Of the 15 cases reported, 8 were resolved, 3 were opened, and 4 were discharging when admitted. Bier (Munch. med. Wochen., Jan. 31, 1905).

Cold, or Tuberculous.

Symptoms. — These abscesses frequently attain a large size, and last for months without their presence being detected. Besides failing general health, the symptoms of the causative trouble are the only prominent ones. The spine, the hips, the genito-urinary tract, and the lymphatic glands are the organs most prone to tuberculous disorders giving rise to cold abscesses. They sometimes appear several months and even years after the beginning of the primary disease.

No pain is experienced, as a rule; cold abscesses are not even tender to the touch. There is no redness until the abscess is about to break, the focus of the liquid mass being otherwise too deeply seated.

Slight hyperpyrexia is usually present. There is no local heat; hence the name "cold" is given this form of abscess by the Germans, to differentiate it from the "warm" abscess.

The above symptoms are usually followed by the sudden appearance of a swelling. Though generally soft, it may be hard, and suggest a tumor in the vicinity of the spinal column (Pott's disease), above or below Poupart's ligament, after burrowing along the psoas muscle (psoas abscess), on the inner aspect of the thigh, or in the lumbar region (lumbar abscess), etc. In the neck cold abscesses are usually due to disease of the neighboring cervical lymphatic glands. The skin either remains normal or gradually becomes thinned and softened until an external opening is formed.

Fluctuation, usually detected with ease, is sometimes hidden by a thick investing layer of lymph, which gives the mass a peculiar tension, suggesting a lipoma or some other hard growth. Aneurisms sometimes convey the sensation produced by a cold abscess: a fact to be borne in mind when operative procedures are under consideration.

Pathology. — A cold abscess can always be traced to a specific inflammatory process, and almost invariably to one of a tubercular nature. Where the confluent masses in the centre of a nodule begin to break down, there is formed a collection of material surrounded by tuberculous tissue. This material becomes infiltrated with leucocytes, and thus is produced a cavity containing fluid fatty material, fragments of cells, and leucocytes, around which there is granulation tissue filled with tubercles. In this way a tuberculous abscess is formed. (Cheyne.) It seems at times to be quite a matter of accident whether the abscess breaks into the joint or finds its way by a more circuitous route into the surrounding connective tissue. As the tuberculous masses spread, caseation takes place at different points in the wall, and the masses are discharged into the cavity of the abscess; but the spread of the abscess is effected generally by what is termed "burrowing of pus." This burrowing occurs in various directions, and large collections of pus, alto-

gether out of proportion to the original lesion, are formed, and are known as cold abscesses. (Warren.)

What has been called a chronic abscess is very often no abscess at all. In tubercular processes the product of tissue-proliferation undergoes coagulation-necrosis, and disintegrates into a granular mass, which, when mixed with a sufficient quantity of serum, forms an emulsion that microscopically resembles pus, but under the microscope shows none of the histological elements which are found in true pus. An abscess can only be called such if it contain pus. A true chronic abscess can originate in a tubercular, actinomycotic, or syphilitic lesion, when the granulation tissue is secondarily infected by the localization of pus-microbes, which convert the embryonal cells into pus-corpuscles. (Senn.)

Differential Diagnosis.—The concomitant disorder usually makes a diagnosis easy in a case of cold abscess; but occasionally the swelling is the only indication of ill health, and it is important to determine, under such circumstances, the nature of the pus. The macroscopical appearances of "laudable" pus and of "sanious" pus are frequently so similar that a *de visu* diagnosis is not justified. Bacteriological examination of the contents of such abscesses will show conclusively whether they are true pus-containing abscesses or whether or not they are pseudo-abscesses. If cultivations are made of their contents, pus-microbes will grow upon proper nutrient media if it be a true abscess, while, from the contents of a pseudo-abscess only the microbes of the primary infection can be cultivated. The information obtained by the discovery of the essential cause can be confirmed by inoculation experiments. (Senn.)

Prognosis. — The walls of cold abscesses are usually tense and tough, and are lined with cheesy tuberculous material. They do not tend to collapse, as is the case with acute abscesses, and for that reason are healed with difficulty. When, however, the seat of the original trouble can be reached and successfully treated, the fluid in the parts of the abscess-tract is absorbed, and the caseous matter undergoes calcification. This fortunate issue of the case is seldom met with, however, and the abscess usually continues, the primary etiological factor acting as a drain for the diseased area. The prognosis, therefore, depends upon the result obtained in the treatment of the latter.

Treatment.—It is a well-known clinical fact that, when such a cold or tuberculous abscess opens spontaneously, or is incised in a careless way, profuse suppuration and hectic fever follow, with only too often a speedy fatal result from septic infection. Unless the surroundings of the patient admit of carrying out the antiseptic treatment to its full and perfect extent, a chronic abscess should not be evacuated by incision. It should be aspirated. When an incision can be made, it should be free, and the cavity should be thoroughly curetted, cleansed, disinfected, and iodoformized, then sutured, drained, and treated as a recent wound.

On general principles, necrosed or detached bone should be looked for in all cases. Strict antiseptic precautions are imperative to avoid mixed infection (bacilli of tuberculosis and pyogenic cocci). Preliminary precautions should be taken to meet violent hæmorrhage due to vascular erosion.

When there is local inflammation and spontaneous opening of the abscess is probable, there should be a free incision, a thorough scraping of its walls with

Volkmann's curette to transform the suppurating surfaces into bleeding ones. The cavity is then cleansed with a 5-per-cent. solution of carbolic acid, a long drain is applied, and the wound is stitched as far as the drain. An antiseptic dressing is then applied. (Volkmann, Trélat, Pozzi.)

After opening the abscess the cavity may be washed out with peroxide of hydrogen in 10-per-cent. solution or packed with iodoform gauze. Removal of the limiting sac is then performed by decortication, the steps being: free incision, the sac detached with finger or spatula and removed, and the cavity closed immediately. (Lannelongue.)

> Peroxide of hydrogen is a prophylactic and curative medicament in the treatment of suppurative skin lesions so common in infants. A twelve-volume solution is ample as a skin-wash twice daily. This rapidly cures superficial lesions. Abscesses must obviously be evacuated before the peroxide solution is used. Cochart (Jour. de Méd. de Paris, April 21, 1901).

The removal of the limiting sac is facilitated by filling the wound with paraffin; the mass can then be removed as if it were a lipoma. (Cazin.)

A psoas abscess should be opened in the loin and groin when possible. In the loin the incision should be made through the external and internal oblique, transversalis, and lumbar fascia, along the outer edge of the erector spinæ to the edge of the quadratus lumborum. The latter muscle and the transversalis fascia are divided on a level with the tip of the second or third lumbar transverse process, avoiding the lumbar arteries. The sheath and the psoas are then perforated with the finger or a trocar. A counter-opening is then made below Poupart's ligament to form a tunnel, into which a large-size drainage-tube is inserted. This is replaced, later on, by a tube at each end to obtain obliteration, beginning from the centre of the canal. If one incision is preferred the loin should be selected.

Aspiration and Injections.—When no local inflammation indicates that the abscess is soon to open, the fluid may be withdrawn with a large aspirator; a 5-per-cent. solution of carbolic acid is injected and then aspirated. This procedure is renewed until the solution withdrawn is perfectly clear. A Lister bandage is then applied, insuring slight pressure. Five days later the treatment is renewed. About five sittings are required. (Boeckel.)

Injection fluids: Iodoform, 1 part; ether, 5 parts; distilled water, 5 parts. Injection not to be renewed while iodoform is being excreted in the urine. (Mosetig-Moorhof, Verneuil.)

Less painful is a mixture of 1 part of iodoform to 10 of glycerin (Billroth) or of olive-oil (Bruns).

Intoxication may be prevented by sterilizing the iodoform and excipient (except ether) by heating at 212° F. separately. (Tillmann.)

Boric acid, a 4-per-cent. solution, may be used as above (Ménard), or naphthol and camphor, 1 part each. About thirty sittings are usually required.

The lesion being a tuberculous one, the general system should be treated accordingly. Nutritious food, including a free supply of milk and eggs, pure air, sunlight, and sea-air, if possible, are indicated, as well as tonics and alteratives (codliver-oil and hypophosphites, iodine, iodides, arsenic, quinine, strychnine, etc.).

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ABSINTHIUM (WORMWOOD).—Absinthium (the *Artemisa absinthium* of

Linné) is a fruit-bearing plant growing in the northern latitudes of Europe, Asia, and Africa, and naturalized in North America. It grows in dry ground and is often found along roadsides. The leaves and tops are utilized in pharmacy, and contain a volatile oil and other constituents,—absinthol, absinthin, etc. The preparations usually employed are an infusion and the powdered leaves.

Dose.—Volatile oil, 1 to 2 minims; infusion, 1 to 2 drachms; powdered leaves, 20 to 40 grains.

Physiological Action. — Absinthium especially affects the central nervous system, and there is a striking resemblance between its toxic effects and a paroxysm of idiopathic epilepsy,—namely, twitching of the muscles of the face and ears, followed by clonic and tetanic spasms of the muscles of the trunk and extremities, with salivation, cries, involuntary emission of urine, and finally a period of unconsciousness.

A cordial—"absinthe"—is extensively used in France as a supposed stomachic tonic and as an intoxicating agent. It surpasses in perniciousness any beverage known, and contributes markedly to the deterioration of that country's population.

Absinthe Poisoning. — As already stated, a poisonous dose of absinthe gives rise to symptoms simulating an attack of epilepsy. In a fatal case there is abolishment of the reflexes, anuria, and finally arrest of respiration and of cardiac action.

> Autopsy of case in which death had followed the ingestion of one and a half pints of pure absinthe. The liver contained 0.21 of 1 per cent. of alcohol, the blood 0.33 of 1 per cent., and the brain 0.44 of 1 per cent. The epithelium of the stomach and that of the kidneys were desquamated. The mucous membrane of the stomach and the renal blood-vessels were very much congested. The stomach presented evidence of hæmorrhage in the larger curvature. Symptoms attributed more especially to alcohol, the characteristic effect of absinthe being the production of epileptiform coma. Pauly and Bonne (Gaz. Hebd. de Méd. et de Chir., May 13, '97).
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> Absinthe is not only an epileptogenic poison, but also a stupefying principle, which would add its action to that of alcohol. Lépine (Gaz. Hebd. de Méd. et de Chir., May 13, '97).

Treatment of Poisoning. — Lavage of the stomach should at once be resorted to even if the respiration, the cardiac action, and the reflexes are apparently abolished.

Therapeutics. — Absinthium was at one time used as antispasmodic, febrifuge, and anthelmintic. It has been generally discarded, however, and is only considered here owing to its present rôle as an intoxicant.

A. C. E. MIXTURE. See CHLOROFORM.

ACETANILID.—Acetanilid (formerly known under the name of *antifebrin*) is a white crystalline powder obtained by the action of glacial acetic acid upon aniline. It is odorless and gives rise to a slight burning sensation when applied to the tongue. It is but slightly soluble in water, but completely so in alcohol and ether.

> Acetanilid is not soluble, but is readily suspended in syrupy mixtures, so that it can be combined with ammonia in any of its forms, salicylic acid, nux vomica, digitalis, codeine, creasote, potassium bromide, or indeed almost any drug, and a prescription obtained that can be much more accurately adapted to the case in hand than any of the ready-made combinations. The foundation of most of the coal-tar product combinations is acetanilid, which has been combined with bicarbonate of soda, caffeine, carbonate of

ammonia, etc. The combination may be chemical or mechanical, it matters little which, as it is practically broken up in the body into the acetanilid radicals and the other constituents. It is much more professional and scientific to write for the mixture than to be slaves to a proprietary combination. Perhaps the most generally useful combination of acetanilid when used as an analgesic is the migraine tablet. This is the equivalent of several of the most widely-used secret mixtures that are sold under a specific name. It consists of 2 grains of acetanilid and ½ grain each of caffeine citrate and monobromate of camphor. A useful combination that can be prescribed in capsule is acetanilid and quinine, 1 grain of the former and 2 of the latter. This makes a good adjuvant to other treatment in cases of coryza. In rheumatic conditions, and those in which there is a suspicion of intestinal fermentation, acetanilid and salol make a good combination in capsule. For disturbances of circulation and neuroses attending the menopause, 2 grains of acetanilid and 15 grains of bromide of sodium are efficient when combined in a drachm of simple elixir. When repeated sufficiently often in this form, it acts as an efficient hypnotic. Acetanilid is a useful addition to mixtures for the relief of acute indigestion attended by flatulence and great distress immediately after meals. As a substitute for iodoform and a host of antiseptic dusting-powders, acetanilid has been found most efficacious, especially when combined with boric acid. L. F. Bishop (Med. News, June 10, '99).

Dose and Physiological Action.—When the drug was first placed on the market, some years ago, the doses administered were excessive. The normal dose in the healthy adult should not exceed 7 grains; 4 grains represent the proper quantity to be administered at a time.

To give antifebrin in doses of 5 and even 10 grains, still more to repeat these after a short interval, is a highly-injudicious procedure. Such doses are excessive, being equivalent to about 25 and 50 grains of antipyrine. This fact of its greater strength has been overlooked. Therapeutic Committee, British Med. Assoc. (Brit. Med. Jour., Jan. 13, '94).

For children the dose should be small, but it need not be reduced to quite the proportion observed for most drugs.

The action of acetanilid upon the heart may become pronounced unexpectedly; its effects should therefore be closely watched in children and weakly individuals.

Case of collapse occurring after a dose of 3 grains. The same dose had been given eight times in the four preceding days without evil result; possible instance of cumulative action. Kronecker (Ther. Monats., Sept., '88).

Fatal case, in a child, from the administration of 3 ⅘ grains every two hours during the day. By evening the child was cyanosed and in fatal collapse. Editorial (Provincial Med. Jour., Mar. 1, '89).

Case of a young woman who took 4-grain doses of the drug at frequent intervals, until, in three days, 48 grains had been taken. On the third day the patient suddenly fell from her chair, unconscious and cyanosed.

The prolonged use of acetanilid is certainly not without danger. This may be of two kinds: 1. The production of marked and more or less transient changes in blood-composition from its long use. 2. Cumulative power in the drug. Robert Haley (Weekly Med. Review, Nov. 9, '89).

Acetanilid used in 1100 cases of diseases of children, in 600 of which a record was kept. Conclusions are: (1) with due care it is a reliable remedy for infancy and childhood; (2) the results are of longer duration and the depression not so great as from the use of antipyrine; (3) the cyanosis which may accompany its use is not dangerous and soon passes away; (4) small, but repeated, doses should be used. I. N. Love (Jour. Amer. Med. Assoc., Mar. 29, '90).

Acetanilid habit in a negro adult suffering from rheumatism. The man found that he was relieved by its administration, but that on leaving off the drug a

few days the pain returned. He began taking it constantly each day and now uses 2 ounces a week. G. W. Gaines (N. O. Med. and Surg. Jour., July, 1900).

Its prolonged administration, even in small doses, may give rise to sudden and marked anæmia and to temporary mental aberration. Experiments in animals have shown that prolonged use tends to cause fatty degeneration of the heart, liver, and kidneys.

Two cases in which gradual loss of memory was produced by long-continued administration (5 to 30 grains) of acetanilid. Memory regained by stopping the drug. Joseph Haigh (Medical World, Oct., '89).

Report of twenty-five physicians of New South Wales. Opinion that symptoms of depression and collapse are more readily produced and are more marked than with antipyrine may be explained by the fall of temperature being greater and more rapid. Most of the reports mention cyanosis to a greater degree that after antipyrine. Anæmia may be induced by its continued use and become a grave condition. D. R. Paterson (Practitioner, No. 304, '93).

Acetanilid Poisoning. — Acetanilid gives rise to severe symptoms of intoxication more frequently than any other agent belonging to the aromatic series, with the exception, perhaps, of antipyrine.

When poisonous doses are taken, there is marked cyanosis, prostration, shallow and labored respiration, palpitation of the heart, weak and thready irregular pulse, dilatation of the pupils, cold extremities, subnormal temperature, cold sweats, and other symptoms of collapse. The drug would therefore seem to be a depressant to the functions of respiration and circulation, with disturbance of the vasomotor system and probably of the heat-regulating centres.

Case of poisoning by acetanilid, in a lady 36 years of age, who had taken about 40 grains in divided doses, in the course of four hours. The chief symptoms exhibited were semi-unconsciousness; delirium; a very feeble pulse; short, rapid breathing; cyanosis of face and lips; and cold extremities. The patient recovered under the use of alcoholic stimulants and the hypodermic injection of strychnine. J. W. C. (Med. Review, May 21, '92).

Case in a woman, aged 21 years, who, two weeks after her confinement, was given, for headache, $^1/_2$ ounce of acetanilid in bulk in an envelope, with directions to take a small quantity of it on the end of a teaspoon every two hours. The patient took two doses as directed, and a few hours afterward, the headache still persisting, she concluded that a very large dose would be more efficacious, and swallowed a teaspoonful of the drug. Half an hour later weakness and dizziness, and an hour later she fainted and passed urine involuntarily. Later on she became cyanotic and semi-conscious. The pulse was slow and extremely feeble, the respirations slow and shallow, the forehead bathed in sweat, and the face livid and perfectly expressionless. The tongue, lips, and finger-nails were intensely cyanotic and almost black; the head, hands, and eyelids were cold, but her feet were quite warm; temperature was normal; there was tingling of the skin over the entire body and some slight mental confusion. There was suppression of urine until noon the next day, and when passed it was of a dark-brown color and very abundant. Loud and continuous borborygmus noticed. The milk secreted by the breast was very much thinner than it had been before the poisoning. The cyanosis lasted for several days. Treatment was that advised by Hare: Patient forced to maintain a recumbent position, the head kept low, and an hypodermic injection of aromatic spirit of ammonia, followed by sulphate of strychnine and sulphate of atropine, given. Hot bottles placed about the body, and $^1/_{60}$ grain of strychnine every three hours given by the mouth, alternating with whisky and aromatic spirit of ammonia. Owing to the condition of the milk, it was not considered wise for the patient to continue nursing

her child, as the milk failed to return to its normal condition after recovery, and the patient was much exhausted. G. Baringer Slifer (Ther. Gaz., May 15, '97).

Case of acetanilid poisoning in a woman, aged 26 years, who had taken 8 grains. Collapse with strong convulsive movements, partial loss of consciousness, and great retching. Whisky, nitrate of strychnine, and—for two hours—artificial respiration induced recovery. O. R. Summers (N. Y. Med. Jour., Mar. 24, 1900).

Case of fatal acetanilid poisoning. The patient, a man of 37, had taken six "headache powders" each containing 10 grains. He became delirious, complained of abdominal pain, vomited, and was slightly jaundiced. His temperature rose to 100.2° F., the lips and nails became intensely cyanotic, respirations shallow and frequent. The urine, of which 10 ounces were passed on admission, was nearly black and strongly alkaline. Anuria occurred, and six days later the man died. There was alternate constipation and diarrhœa, and forty-eight hours before death the fæces constantly showed blood-pigment, blood-clots, and corpuscles. Philip Brown (Amer. Jour. Med. Sciences, Dec., 1901).

While subnormal temperature may result from the administration of even small doses, it is not always present in cases of poisoning.

Subnormal temperature, in a man aged 40 years, produced by a second dose of 7 grains two hours after the first. T. M. Dunagan (Memphis Med. Monthly, Mar., '91).

The toxic properties of acetanilid too often appear when the drug is given in small doses. In some cases symptoms become so severe that a fatal result may be imminent, unless prompt treatment is employed. Having been widely advertised as a universal analgesic, a large number of remedies for the relief of pain, under catchy titles, contain this drug as an essential ingredient. Fifteen grains is commonly considered the maximum dose, yet one-third of this quantity has been personally seen to produce alarming symptoms. Authors have occasionally advised that 3 grains be given each hour, but patients reach the danger-line long before the maximum quantity was given in this way. Two 4-grain doses caused nearly fatal issue in a case in an adult described by O. R. Summers.

Personal case in which the patient had taken four headache powders. The headache powder had been taken each hour, beginning at nine o'clock and ending at noon. The surface of the body presented an ashen-gray appearance, the mucous membranes having a much darker hue. The temperature was 96 degrees; pulse, 60; and respiration, 10. Digitalis, strychnine, and alcohol-baths with friction were employed, with dry heat to the surface. When the patient was able to swallow, a combination of aromatic spirit of ammonia, brandy, and capsicum was given. Twenty-four hours later the temperature was slightly subnormal, the dusky appearance of the face disappeared to a large extent, but the symptoms of cyanosis did not wholly vanish until the second day. The powders contained 3 grains of acetanilid, 2 grains of bicarbonate of sodium, and 1 grain of caffeine; hence the total dose was 12 grains of acetanilid. Conclusion that under no circumstances should acetanilid be administered alone, but always guarded by a cardiac stimulant, while the intervals between doses should be sufficiently prolonged. Earps (Merck's Archives, June, 1901).

The cyanosis is probably due to the liberation of free aniline in the blood, and is more likely to occur when the acetanilid is imperfectly manufactured. An excess of aniline is present when the acetanilid employed gives a reddish-orange precipitate with sodium hydrobromite.

Acetanilid is an effective agent for the treatment of wounds, causing rapid healing in subjects whose powers of resistance to toxic effects are not greatly below par. In infants and aged people, for instance, the possibilities of untoward effects are greater than in youths or adult subjects. Idiosyncrasy may also

enter for a share in the cases of poisoning reported. In the aged the resolutive process may be retarded by its use.

Marked instance in an infant in which it had been applied to the navel. Face, lips, fingers, toes, and the whole of the skin and visible mucosa of a dark-blue color. Rectal temperature was 99° F.; respiration, 60. Oxygen, whisky, and digitalis were administered. No effect upon cyanosis noticed from the oxygen inhalations. Not until the fourth day did the child regain its former strength and disposition. I. M. Snow (Archives of Pediatrics, June, '97).

In obstetrics acetanilid used as an antiseptic in all injuries occurring in the course of the three thousand cases seen by her since 1894. It always caused rapid resolution of the wound without suppuration. It also exerted a distinct analgesic action, which was particularly noticeable in the painful tears in the region of the clitoris, the urethra, and the vulva. Prokopieff (Vratch, xxi, No. 14, 1900).

Case of a woman, aged 50, who had for seven years applied acetanilid daily to an extensive varicose ulcer of the leg. She was suffering from general nervousness, weakness, dyspnœa, cyanosis, and palpitation. Stoppage of the applications was followed by maniacal excitement. The liver and especially the spleen were enlarged, there was a moderate degree of secondary anæmia, no hemiglobinæmia or methæmoglobinæmia. The urine was dark in color and contained paramidophenol and excess of ethereal sulphates, no albumin, sugar, or casts. Recovery followed gradual withdrawal of the drug. The authors review the symptoms and the subject of chronic acetanilid poisoning generally, and discuss its diagnosis, which is easy if the condition is suspected; otherwise it may be mistaken for other conditions attended with anæmia and cyanosis. In cases of cyanosis not explained by cardiac disease, emphysema or other usual causes, intoxication by acetanilid or other coal-tar product should be looked for. They believe that there are many cases of anæmic, neurasthenic, or run-down patients who are really suffering from acetanilid intoxication in a mild degree. Careful inquiry should be made in such conditions when other explanations of the symptoms are lacking, but it must be remembered that such patients may conceal the drug habit as artfully as the morphine habitué. An examination of the urine may prove the taking of the drug. The treatment is comparatively simple. With gradual withdrawal of the drug, the temporary substitution of codein to relieve pain, and the use of tonics and attention to the stomach and bowels, recovery will usually ensue. Watchfulness against relapse is necessary, but the habit has not usually the strong hold on the patient as morphine or cocaine. Even in the worst cases a hopeful prognosis can usually be given. J. B. Herrick and E. E. Iron (Jour. Amer. Med. Assoc., Feb. 3, 1906).

While acetanilid forms an excellent dressing for wounds, burns, and exposed surfaces in general, it is easily absorbed by the latter, and may thus give rise to active toxic symptoms, especially in infants, as shown above.

The following combination recommended in numerous diseases, applied in the form of a powder or a paste:—

℞ Acetanilid, 3j.
Zinc oxide, 3iij.
Iodized starch (5 per cent.), 3iv.

The iodized starch should be properly prepared and the acetanilid finely pulverized. Sufficient water is added to make a paint or paste, to be applied with a stiff brush. Liquid albolene, benzoin, or olive-oil may be used instead of water when the application is intended for dry surfaces or ulcers; a gauze bandage may be used to prevent it from being rubbed off. When dry the powder is of light-drab color, when wet of a slate color, but when in contact with pus it turns white, showing that the iodine has been liberated. This combination of the drugs gives an antiseptic, astringent, soothing, and protective remedy, having remarkable healing properties, useful in eczema, ulcers, dermatitis from all causes, in-

cluding superficial burns, impetigo, sycosis, herpes zoster, and chancroids. T. G. Lusk (Jour. of Cutaneous and Genito-urin. Dis., Dec., 1901).

Treatment of Acetanilid Poisoning.—In the treatment of poisoning by acetanilid cardiac, respiratory, and vasomotor stimulation is of great importance. Ether, hypodermically, has been most frequently used. Belladonna is probably the best drug to fulfill the indications; it tends to equalize the blood-pressure, and with external warmth and some more direct cardiac stimulant—brandy, etc.—presents the needed qualities for antagonizing the overaction of acetanilid.

Therapeutics.

Fever.—Acetanilid should not be used as an antipyretic. Like all coal-tar products, its employment as such is dangerous. Not only is a rise of three or four degrees harmless, but modern investigations tend to show that it is one of Nature's means of defense against pathogenic elements of various kinds. The many cases of marked depression that have followed its use even in moderate pyrexia of infectious fevers have caused its use to be abandoned. Northrup severely condemns its use in children.

It is as an analgesic and an antispasmodic that acetanilid finds its chief value, and in such conditions it should be given in much smaller doses—from 1 to 2 grains to an adult and 1 grain to children. It is one of the best remedies if given in moderate and safe doses. It is one of the best remedies for the relief of pain not due to local inflammation. It is a valuable adjuvant to other remedies, such as quinine, salicylates, opium, and calomel. It is an excellent corrective when administered with quinine, and enhances the therapeutic effect of the latter drug. Acetanilid is antagonistic to opium in some of its spheres of action and supplemental in others. It takes from opium that subtle soporific effect which follows its anodyne action. J. R. Johns (Amer. Med., May 21, 1904).

Malaria.—It has been found serviceable by several observers in warding off the periodic manifestations of intermittent fever.

Acetanilid possesses great merit in warding off chills in intermittent fever. If there is time, before the chill 1 1/2 to 2 grains of calomel in 1/4-grain doses half an hour apart are given; then, according to age, 2 to 6 grains of acetanilid twenty minutes or half an hour before the expected chill. Gentle perspiration with natural sleep usually follow within half an hour; if not, a second dose of equal amount may be given. Used in several hundred cases without quinine. Benjamin Brodnax (North Carolina Med. Jour., Apr. 20, '95).

Typhoid Fever.—Early in its career acetanilid was found more harmful than beneficial in this affection. It tends to depress vital energy, which, on the contrary, should be sustained. Its use in this disease has been practically abandoned.

Classes of patients who exhibit susceptibility to the influence of acetanilid. In a number of cases of pregnant and nursing women who were suffering from typhoid fever, disagreeable or alarming symptoms observed to follow the exhibition of any but very moderate doses of the drug. Larger, but still moderate, doses were frequently followed by profuse diaphoresis, or even collapse. Sembritzki (Ther. Monat., June, '89).

Phthisis.—The same reasons cause acetanilid to be contra-indicated in this disease. It has been used to counteract the afternoon rise of temperature, but the advantage gained is more than offset by the depression produced.

Case of a young man, with acute pulmonary tuberculosis, in whom 10 grains produced collapse. James Wilding (Brit. Med. Jour., Sept. 14, '89).

Nervous Disorders.—*Pertussis.*—It is in the diseases of the nervous system

that acetanilid has shown itself most valuable. As an antispasmodic in whooping-cough its effects are quite marked.

Neuralgia and Kindred Disorders. — As an analgesic, especially in cases of neuralgic or neuritic nature, or in pain from reflex causes, acetanilid has been of marked benefit. In rheumatism, sciatica, lumbago, trifacial and other neuralgias, gastralgia, girdle-pain of locomotor ataxia, ovarian or other visceral pain, the pain of optic neuritis and glaucoma, it has been freely used, and still maintains a well-deserved reputation. It is also effective in the neuralgic pains associated with herpes zoster.

Five-grain doses successfully relieve the lightning pain of locomotor ataxia. Stewart (Canada Med. Record, Jan., '88).

Of great advantage in 5-grain doses, repeated every two hours, in painful menstruation, especially of young girls. H. B. Ely (Medical World, Jan., '91).

Epilepsy.—In epilepsy, however, it has not shown itself effective, even when administered in sufficiently large doses to produce cyanosis.

Vomiting. — Vomiting of nervous origin occasionally yields to its action.

In obstinate vomiting, particularly when it seems to be due chiefly to nervous disturbance or marked gastric irritability. Two grains every hour until 6 grains are taken often prevent this unpleasant sequel of operative interference. Hare (Ther. Gaz., Nov. 15, '94).

ACETIC ACID. — Acetic acid is an organic acid obtained from vinegar, of which it represents the active principle. It is also obtained from crude pyroligneous acid. It is a clear, colorless fluid having a strong pungent odor and an intensely-acid corrosive taste. It contains 36 per cent. of glacial acetic acid: a monohydrate presenting the physical properties of acetic acid, which, in turn, becomes crystalline at 34° F.

Dose.—The dilute acetic acid is officinally prepared by adding 1 part of acetic acid to 5 of water, and is used as a local astringent and stimulant.

Glacial acetic acid is employed as an escharotic. The crystalline form is mainly employed with sulphate of potassium in the preparation of smelling-salts.

Experiments to ascertain whether acetic acid cannot be used instead of alcohol to avoid the dangers of the alcohol habit. Nux vomica, kola, cinchona, sanguinaria, ipecacuanha, and colchicum-seed successfully exhausted with varying strengths of acetic acid. Joseph P. Remington (Amer. Jour. of Pharm., No. 3, p. 121, '97).

The constituents of acetic-acid preparations may be divided into (*a*) those which hasten the evaporation of the acetic acid (this group includes all powdery substances—kieselgur is the most active, then comes kaolin; sulphur and flour have a slighter effect); and (*b*) those which retard the evaporation of the acetic acid (glycerin comes first, then adeps benzoatus, and lastly vaselin). Following preparations of acetic acid recommended:—

1. Adeps lanæ, 7 parts.
   Acetic acid (30 per cent.), 7 parts.
   Benzoated lard, 7 parts.
2. Adeps lanæ, 6 parts.
   Acetic acid (30 per cent.), 7 parts.
   Benzoated lard, 2 parts.
   Kaolin, 6 parts.
3. Glycerin, 5 parts.
   Acetic acid (30 per cent.), 7 parts.
   Kaolin, 9 parts.

Following "acetic-acid-and-sulphur paste" is very useful in acne:—

4. Adeps lanæ, 6 parts.
   Acetic acid (30 per cent.), 7 parts.
   Benzoated lard, 6 parts.
   Precipitated sulphur, 2 parts.

All these preparations contain 10 per cent. of anhydrous acetic acid, and consequently are strong preparations of the acid. Unna (Treatment, vol. ii, p. 373, '98).

Physiological Action. — In free dilution acetic acid is an excellent antiseptic;

but, administered without the admixture of bland liquids, it causes intense irritation, owing to its property of effecting a partial solution of albuminous bodies and of dissolving gelatinous tissues. Acetic acid combines with the alkaline bases within the system, forming acetates that are diuretic and diaphoretic.

Acetic-Acid Poisoning. — The escharotic action of acetic acid, by manifesting itself upon the mucous membrane of the pharynx and larynx, is liable to cause œdema of the glottis: a danger to be at once thought of. The immediate manifestations are severe pain in the mouth, throat, œsophagus, and stomach, with retching and vomiting and other symptoms attending violent irritation of the digestive tract.

Treatment of Acetic-Acid Poisoning.— Alkalies and demulcents should be employed. The bicarbonate of soda in free solution is an effective remedy. Ordinary soap—one containing an alkali—can be used in solution until an alkaline salt is available.

> Case of a girl, aged 19 years, who swallowed a considerable amount of strong acetic acid with suicidal intent. She immediately was seized with violent vomiting and with pain and intense burning in the mouth and pharynx. At the hospital she developed a series of pronounced symptoms, which are interesting in view of the rarity of cases of acetic acid poisoning. There was a frequent and feeble pulse and a slightly elevated temperature, a persistent and violent cough with a very abundant purulent expectoration, a veritable bronchorrhœa, and occasionally efforts at vomiting which were not successful. The urine was black and smoky, like that of carbolic acid poisoning, and contained 1 per cent. of albumin. The red blood-discs in the fresh blood were very pale, with little tendency to form rouleaux, and with frequent mulberry-shaped distortion. The serum, when separated, had a distinct reddish tint, showing that the hæmoglobin had been dissolved from the cells. The heart-sounds and the apex-beat were very weak. The symptoms gradually disappeared, and the patient was discharged cured. The treatment consisted of stimulation in the shape of injections of caffeine, a milk diet, and the use of pieces of ice and of a tannin gargle for the throat. Special attention called to the changes in the blood, the purulent bronchitis, and the degenerative changes in the myocardium resulting in heart-weakness with danger of cardiac failure. Giordano (Riforma Medica, Jan. 27, 1904).

Therapeutics.—As an antiseptic, acetic acid is possessed of considerable power. As such it may either be applied locally or its fumes may be inhaled.

> **In an emergency vinegar is useful for disinfecting the hands and the region operated upon. L. Fürst (Deut. Aerzte-Zeit., June 15, 1900).**

Acetic acid is frequently used as a stimulant. When inhaled its stimulating effects upon the nervous supply of the nasal mucous membrane causes it to sometimes act rapidly in restoring consciousness after fainting. In the same manner it may also arrest vomiting and headaches of nervous origin.

> **Vinegar as a remedy against vomiting in chloroform narcosis. Handkerchief moistened with vinegar applied to the nostrils and permitted to remain until patient returns to consciousness. Warholm (Univ. Med. Jour., Dec., '93).**

As an escharotic it is often used on corns, warts, condylomata, and fungous growths. The glacial acetic acid should be used for this purpose.

Skin Diseases. — Acetic acid is useful in many disorders of the skin. In alopecia it has been used with advantage as a vesicant.

When alopecia is extensive the scalp should be shaved and acetic acid, in greater or less proportion, mixed with equal parts of chloroform and ether, ap-

plied. Or Besnier's formula may be employed:—

℞ Chloral hydratis, 75 grains.
Ætheris, 6 drachms.
Acid. acetic. cryst., 15 to 75 grains.

M. These applications are repeated two or three times a week at first and later at longer intervals.

Between-times a stimulating oil—as of eucalyptus and turpentine, of each, ½ ounce; crude petroleum and alcohol, of each, 1 ounce—is applied. This is to be followed by a thorough massage of the scalp for five minutes by the patient. Once a week, or oftener, the scalp is to be thoroughly shampooed with tincture of green soap. Morrow (Jour. of Cut. and Genito-Urin. Dis., Oct., '91).

In rodent ulcer and lupus vulgaris acetic acid is of use; but in the latter affection the benefit is only temporary.

In eleven out of twelve cases ulcus rodens observed the ulcer was situated upon the lower lid. Treatment, by means of daily applications of a 75-per-cent. solution of acetic acid and subsequent rinsing with water, followed by good results. Wagner (Gräfe's Archiv f. Oph., B. 33, Ab. 3, '91).

In rodent ulcer. Cure of a young girl attacked with vitiligo of the body and alopecia of the scalp, in which the treatment consisted of two applications of acetic acid, together with stimulating lotions (tincture of rosemary, Van Swieten's solution, and tincture of cantharides). Feulard (Le Bull. Méd., Jan. 15, '93).

Diseases of the Nose and Throat.— Acute coryza is sometimes arrested by the inhalation of acetic acid.

Glacial acetic acid is useful in preventing the development of hay fever by applications to the nasal mucous membrane twice per week. In practically all cases, however, the applications must be renewed each year. (Sajous.)

In hypertrophic rhinitis it may also be used in the same way; but chromic acid is more effective.

In tubercular laryngitis it has given good results in arresting ulceration. The ulcers are first scraped and the acid is then applied with a laryngeal applicator.

ACETONURIA.—Acetone (C_3H_6O = dimethylketone = $CH_3—CO—CH_3$) is a thin, watery, very movable, odorless liquid of neutral reaction. It has a curious aromatic odor, resembling somewhat that of acetic ether or of oil of peppermint. It is soluble in water, in alcohol and ether in all proportions; evaporates at ordinary temperatures; boils at 56.5° C.; and has a specific gravity of 0.81. Acetone can be obtained by the distillation of acetate of barium. Oxidation of acetone causes the formation of acetic acid and formic acid. As a product of metabolism, it was discovered by Petters, in 1857, in the urine of a diabetic patient.

Acetone is found in the urine of healthy individuals in quantities not exceeding 10 milligrammes per day, which, during starvation (Müller), can increase to 780 milligrammes per day. In some diseases it increases to 0.2 to 0.5 gramme daily. By distilling the urine examined, acetone can be obtained in a purer state, although still united with other volatile constituents of the urine.

Physiological and Pathological Excretion of Acetone. — Pathological acetonuria is observed (1) in fevers, (2) in diabetes, (3) in some forms of carcinoma which have not as yet induced inanition, (4) in psychoses, (5) in autointoxications, and (6) in different disorders of the digestion. Lorenz observed acetonuria and excretion of acetone with the fæces and the vomited matter in a case of peritonitis. In fevers acetonuria is constantly observed, and in the fevers of children as well (Baginsky). In cases of diabetes, acetonuria occurs when the disease has continued for a long time, and

especially when the patients are put on an exclusive diet of proteids or proteids and fat, or when the allowance of food is not sufficient to maintain the equilibrium of metabolism.

In fevers, as well as in diabetes, acetonuria is often accompanied by excretion of diacetic acid and beta-oxybutyric acid.

The Origin and Pathological Significance of Acetone, Diacetic Acid, and Beta-oxybutyric Acid. — The origin of acetone in the organism has not yet been ascertained. Cantani was of the opinion that it was formed in functional disorders of the digestive tract; Petters and Kaulich argued that it was due to fermentations in the bowels. Markownikoff ascribed it to a fermentative product of sugar.

Acetonuria of intestinal origin cannot be denied, but its occurrence from this cause is probably much rarer than many have imagined. S. Boeri (Revista Clin. e Terapeutica, Nov., '91).

The development of acetonuria from affections of the intestines of the most varied character is a phenomenon so constant that it would be well to add to the already recognized varieties of the condition a class caused by intestinal disturbances. In these cases of digestive fault it seems impossible to separate acetonuria and diaceturia, in that the differences in clinical manifestations between these substances are but slight, and really only quantitative in character, and the combination or alternation of the two conditions is almost always the case. The symptoms formerly attributed to these substances do not appear to be due to them, but to lower oxidized forms. When albuminuria exists it does not seem to be in any way dependent upon either of these substances. Acetone is to be found (sometimes in large amounts) in the contents of the stomach and intestine in many cases. There is a great difference between the primary and secondary gastro-intestinal affections, especially of nervous origin; in the former the gastric contents almost always contain acetone; in the latter it is rarely found. In several cases oxybutyric acid was also found in the urine. Lorenz (Oesterr.-ungar. Cent. f. d. med. Wissen., '91).

Experiments to ascertain whether Mayer's view that acetonuria is an evidence that an acid intoxication of the organism exists are correct.

Strychnine poisoning produced in a number of dogs, thus causing an acid intoxication through the muscular spasm. In no instance was acetonuria the result.

Acetone looked for in 31 epileptics also, after convulsions, and found in only 13 instances and in but small quantities; several of these patients had acetone in their urine before the convulsions.

To see whether acetone comes from the gastro-intestinal tract calomel was given to a diabetic girl that showed acetonuria. Were the acetone formed in the gastro-intestinal tract it would seem probable that after the disinfecting and purgative action of the calomel the quantity of the urine would be less. On the contrary, the amount was rather greater than less, and at any rate it was not decreased. Hugo Lüthje (Centralb. f. innere Med., Sept. 23, '99).

The necessary condition for the production of acetonuria is an insufficient decomposition of hydrocarbons, either from their absence in the diet or from impaired powers of decomposition on the part of the organism (diabetes). In advanced diabetes acetonuria is a grave symptom, threatening coma. This coma may be delayed by the administration of large doses of sodium bicarbonate. It is probable that the bodies of the acetone series are formed in considerable quantity in the organism, to disappear completely later. They doubtless represent links in a continuous series of transformations in which oxybutyric acid-beta is the primordial term. H. C. Geelsuyden (Norsk Mag. f. Laegevidensk., July, 1900).

Albertoni did not find acetone in the urine of animals which had received large doses of glucose (100 grammes) or

of different primary saturated alcohol; when isopropylalcohol was ingested it was excreted partly unaltered and partly changed to acetone, and when acetone was given to animals it was discharged by the urine, even if the dose of acetone ingested did not exceed 8 centigrammes.

When Gerhard detected the presence, in the urine, of a substance which gave a dark, wine-red color by means of a solution of perchloride of iron, he believed this substance to be diacetic ether, and was of the opinion that acetone was derived from this substance, which can easily be disintegrated into acetone, alcohol, and carbonic acid. Fleischer and Tollens proved this to be an error, and found that the coloring substance—at least, in the majority of cases—must be diacetic acid, which can be separated from the urine by the addition of sulphuric acid and extracted with ether. This opinion is supported by von Jaksch. Minowski caused acetonuria by extirpation of the pancreas, and von Mering by intoxication with phloridzin.

Lustig found that extirpation of the solar plexus in animals provoked acetonuria, glycosuria, and emaciation, while Oddi obtained the same results by sugar injections.

> Acetonuria may not depend upon the extirpation of the cœliac plexus. It is to be noted that septic peritonitis is avoided with difficulty. Acetonuria observed for three days in a woman operated on for salpingitis. On the other hand, it was not met with in a dog which had undergone, under all antiseptic precautions, subdiaphragmatic section of the vagus and extirpation of the ganglia. Contejean (Archives de Phys. Brown-Séquard, Oct., '92).

Lorenz is of the opinion that diacetic acid and the beta-oxybutyric acid are the substances from which acetone is derived, and that they are the real causes of the toxic symptoms observed in acetonuria, while acetone itself is relatively innocuous.

Von Engel found a great quantity of acetone in the urine of a patient suffering from lactonuria; when the milk was removed by a suckling apparatus the acetonuria disappeared. Very much acetone was found in the urine of patients suffering from severe chronic morphinism. In different acute fevers acetonuria is rather a constant symptom; in typhoid fever von Engel found it constantly; acetone was only missed when the typhoid fever was accompanied by obstipation.

> Acetonuria occurs not infrequently in children, especially in febrile affections and in acute gastro-intestinal derangements. It may, however, be absent even in high and continuous pyrexia. Diaceturia, likewise, is frequent in children, and is almost constant in high and continued fever; and is common in the acute infectious processes, even if there be but little attendant fever,—as, too, is the case with acetonuria. Schrack (Fortschritte der Med., Oct. 1, '89).
>
> Acetonuria was studied in twenty-six cases. In physiological pregnancy at the ninth month acetonuria is more marked than in the non-pregnant state. In labor the acetonuria increases, especially if the parturition be prolonged. In the puerperium it diminishes, remaining, however, greater than in pregnancy till after the sixth day. The view that acetonuria can be regarded as a sign of fœtal death is not sustained. R. Costa (Ann. di Ostet. e Gynec., xxiii, Mar., 1901).

Becker found that acetonuria increased after narcosis, the case being the same with an already existing acetonuria. This would seem to explain why acetonuria has been observed after great operations.

> Operations are frequently followed by acetonuria, but, contrary to what has been claimed, this is not the result of opening the peritoneum or of the use of sublimate. It also causes no pathological reaction. Though traces of acetone may be met with in normal persons, this is

not always the case, and it cannot, therefore, be regarded as a necessary product of metabolism. Conti (Wratsch, Dec. 7, '93).

In healthy subjects after narcosis acetonuria sets in, lasting from a few hours to several days. This post-narcotic acetonuria indicates an increased destruction of albumin. Ernst Becker (Virchow's Archiv f. Path. Anat. and Phys. u. f. klin. Med., Apr. 2, '95).

Acetonuria follows anæsthesia in two-thirds of the cases, the anæsthetic used making no difference; if acetonuria is present before, anæsthesia increases it. The practical outcome is that, except in cases of urgency, anæsthetics should not be administered to diabetic patients. Abram (Jour. Path. and Bac., p. 3, 430, '96).

Marked and prolonged acetonuria detected during retrogression of fibroids after oöphorectomy or ligature of the ovarian arteries. Bossi (Arch. di Ostet. e Ginec., vol. iv, p. 4, '98).

Acetone, diacetic acid, and beta-oxybutyric acid are found in great quantities in the urine of diabetic coma, and different authors—Munser and Strassez, for instance—believe these substances to be the real cause of coma, perhaps by causing an excess of acidity in the organism.

In comatose patients who do not suffer from diabetes—as, for instance, in saturnine encephalopathies, etc.—diacetic acid is often found in the urine. Von Jaksch has proposed to give the name of "coma diaceticum" to these cases of coma. Nevertheless, neither acetone nor diacetic acid and oxybutyric acid have very prominent poisonous properties. Kussmaul gave animals 6 grammes of acetone per day without effect. Buhl, Tappeiner, and Frerichs came to similar results. Albertoni found the lethal dose of acetone for dogs to be about 6 to 8 grammes per kilogramme of the dog's weight.

Case of cerebral apoplexy in which sugar and acetone were detected in the urine. The coma had come on suddenly, and was regarded as diabetic from the urinary condition; but the autopsy revealed an extensive cerebral hæmorrhage. Ruttan and Johnston (Montreal Med. Jour., Mar., '91).

Geelsuyden draws the conclusion from many experiments on rabbits that, even when small (10 to 20 milligrammes) subcutaneous injections of acetone are given, the acetone is excreted with the urine; in larger doses more acetone is excreted; but only a portion of the injected quantity reappears; another portion of it is excreted with the expired air; but still a portion is left which does not reappear and must therefore have been disintegrated in the body of the animal. After the injections albuminuria takes place. An adult rabbit can bear an injection of 2 grammes of acetone, but is killed by the injection of 6 grammes. In starving animals the experiments gave the same results; a portion of the injected acetone reappeared in the urine and the expired air, while still another portion was disintegrated in the body. Geelsuyden draws from these experiments the conclusion that the acetonuria observed in starving individuals is not caused by a diminution of the power to disintegrate acetone already formed in the body, but to an increase of the amount of acetone formed in the body.

Modern authors generally admit that acetone is a product of the metabolism of proteids. Hönigmann and von Noorden are of the opinion that acetone is only formed by diminution of the organized albumin of the body, and never by the metabolism of the proteids ingested with the food, be the quantity ever so large. Hönigmann supported this theory principally by experiments made on himself, which proved that when he lived exclusively on large quantities of proteids

—that is, when nutrition was insufficient —acetone and diacetic acid were found. The acetonuria was not augmented when more albumin was ingested, but disappeared when he took plenty of carbohydrates in addition to the proteids. Von Engel, on the contrary, is of the opinion that in all cases when great quantities of albumin are decomposed in the body the quantity of acetone excreted with the urine will increase considerably,—equally if the albumin is ingested with the food or taken from the stock of the body.

Relations existing between pathological acetonuria and azoturia in several diseases (diabetes mellitus, typhoid fever, pneumonia, phosphorus poisoning): acetone seems to increase, especially in those cases where destruction of albuminoid matters is also increased, whether they be of organic nature or belong to the albumin of alimentation. A direct proportion between the amounts of acetone and albumin has not been observed. A solution between the two is sometimes observed, but it is by no means constant. Palma (Jour. de Méd. de Chir. et de Pharm. Bruxelles, Feb. 2, '95).

Twenty-six cases of acetonuria studied. In physiological pregnancy at the ninth month the acetonuria is more marked than in the non-pregnant state. In labor the acetonuria increases, especially if the parturition be prolonged. In the puerperium it diminishes, remaining, however, greater than in pregnancy till after the sixth day. The view that acetonuria can be regarded as a sign of fœtal death is not sustained. R. Costa (Ann. di Ostet. e Gynec., xxiii, March, 1901).

Weintraud and Hirschfeld are decided opponents of this theory. Weintraud argues that—in a case of severe diabetes where complete equilibrium of the metabolism, and especially of the metabolism of nitrogen, was maintained for a long time, so that no albumin contained in the tissues was consumed—acetone, diacetic acid, and beta-oxybutyric acid were constantly excreted with the urine; the diet was free from carbohydrates; when, also, the quantity of proteids was somewhat reduced the sugar disappeared after twenty-four hours; the weight of the body was maintained, but acetone and diacetic acid were still excreted.

Carbonate of soda augmented the quantity of acetone excreted, without diminishing the quantity of oxybutyric acids. When, in periods of twenty-four hours, no food at all was taken, acetonuria was greatly increased. Ingestion of carbohydrates diminished the acetonuria even in persons suffering from diabetes; levulose, milk, and sugar have the same property; glycerin, also, as observed by Hirschfeld. The addition of fat to the food has no power to arrest the acetonuria.

Hirschfeld found that when he put two individuals on light diet, consisting only of proteids and fat, diminution of albumin of the body, as well as acetonuria, was produced. When carbohydrates were added to the food the acetonuria diminished, and that to a much greater degree than the diminution of albumin. Ingestions of fat had absolutely no influence in diminishing acetonuria, although it diminished the loss of nitrogen. Acetonuria is more marked when the albuminous food is scarce than when it is given in great quantities. The ingestion of carbohydrates has an extraordinarily rapid effect on the production of acetonuria, the quantity of acetone being considerable within two hours. Experiments in persons who were almost starving have proved that a moderate quantity of carbohydrates was sufficient to bring about marked diminution of acetonuria in spite of the considerable loss of albumin and fat which still took place.

Objections to the view that pathological acetonuria is due to autointoxication.

It was formerly thought that, apart from diabetes, acetonuria might occur in the fasting state, in fever, and in special diseases, such as carcinoma. The increased production of acetone was looked upon as the result of increased albuminous decomposition. This rests on a false basis. It was known that acetone was present in the urine in people fed exclusively on albuminous foodstuffs and fat, and that the increase disappeared when carbohydrates were taken. The author showed that even small quantities of carbohydrates had a very considerable effect on the acetone excretion; that the acetonuria found in febrile affections and in carcinoma could be made to disappear when abundant carbohydrate foodstuffs were given, and that it increased when the patient could eat less. The question of acetonuria in diabetes is in accord with the view of its connection with carbohydrate metabolism. There is very little difference between the healthy and diabetics, as long as the latter can deal with the largest part of the carbohydrate foodstuffs supplied, but when the carbohydrates are excreted as sugar the acetone in the urine is increased. The difference between the healthy and diabetics is that in the latter, notwithstanding abundant carbohydrate foodstuffs, acetone excretion is abundant, and that, whereas in the healthy the acetone in the urine does not exceed 0.9 gramme, in the diabetic it is much above 1 gramme. It is only correct to speak of a pathological acetonuria in diabetes. Hirschfeld (Cent. f. inn. Med., June 13, '96).

Geelsuyden, from his experiments on rabbits and dogs already mentioned, reached the conclusion that acetone is formed in the tissues, not in the kidneys; that the kidneys give passage to the acetone even when their blood contains a very small quantity of it; and that pathological acetonuria is not caused by a defect of disintegration of acetone in the body, but by a disorder of the general metabolism leading to the formation of an anomalous large quantity of acetone. Geelsuyden has further conducted a series of experiments in healthy individuals (medical students) put on different scales of diet, which were strictly controlled. As all observers did, Geelsuyden found that when a person was put on exclusive flesh diet acetonuria appeared, and at the same time the body lost albumin as well as fat; when large quantities of proteids were ingested, acetonuria was less considerable than when less albumin was given. Complete starvation, an exclusive fat diet, and a diet of proteids, with the addition of a great quantity of fat, cause a very considerable amount of acetone to be excreted. As exclusive diet of fat and complete starvation give rise to the excretion of the largest quantity of acetone, it seems that acetone is formed by disintegration of fat, and that in this respect there is no difference between the fat of the food and that of the tissues. Carbohydrates have a great power to check the excretions of acetone; when individuals were put on a diet without carbohydrates and secreted urine containing a great quantity of acetone, the acetonuria disappeared in a few hours when carbohydrates were given. From 150 to 200 grammes of carbohydrates per day are required to check an already existing alimentary acetonuria.

In the opinion of Geelsuyden, acetonuria occurs when carbohydrates are not ingested in sufficient amount, and acetone is formed by the disintegration of fat, either of that of the tissues or of that contained in the food.

Preliminary Tests for Acetone.—With an alkaline solution of sodium nitrocyanide (of a slightly-red hue) acetone gives a ruby-red color, changing, after some time, to yellow, and after acidifying with acetic acid and boiling, to greenish-violet.

The cyanide-of-soda test, after Legal

or le Nobel (see below), may be employed as preliminary test; but, to make the presence of acetone positive, it is necessary to separate it from the urine by distillation. As the boiling-point of acetone is low (56° C.), this may be done at a low temperature, and the use of a water-bath is recommended.

Legal's Test. — To ten cubic centimetres of urine a small crystal of nitrocyanide of soda or some drops of a freshly-made solution of this reagent are added; the fluid is rendered strongly alkaline by a 30-per-cent. solution of caustic soda or potash. When acetone is present a beautiful-red color will appear, which will change only after some time to yellow; the red color produced in the same manner by creatinin becomes yellow sooner. Legal adds that, when acetone is present and the urine, shortly after the addition of the solution of soda, is neutralized with acetic acid, the urine assumes a purple-red color, and, when diluted with water, a crimson hue. When the acetic acid is floated on the urine a crimson ring will appear at the point of contact, and, when much acetone is present, the color of the ring will be purplish red.

Le Nobel's Test. — Le Nobel and Fehr hold that Legal's test is only reliable when much acetone is present; and that, when there is only a small quantity of it in the urine, the test may be fallacious, since other substances contained in the urine can produce a red color with the nitrocyanide of soda. The most characteristic point of the test is, according to Fehr, the appearance of the violet hue, which causes the red color to become crimson or purple, and not pure red.

Le Nobel proposes to substitute a solution of ammonia for the solution of soda, when the test is, in other respect, made according to the indications of Legal; the fluid containing acetone is not immediately colored, but after some time, when the liquid is shaken with air or some drops of a strong acid added (the alkaline reaction being maintained), the fluid takes a rose-red color, increasing gradually and changing after some time to violet wine-red. By heating the fluid the color disappears, but returns on cooling down; when boiled with acids it changes into greenish violet. Le Nobel's test is more delicate than Legal's, and will reveal 0.00025 gramme of acetone.

Fehr's Test.—Fehr also employs the test after the method of Legal, but proposes, when the color of the urine after the addition of solution of soda is passing from dark red to yellow, to float some drops of acetic acid on the urine. When the test-tube is slightly rotated so that only a small quantity of the acid mingles with the urine, a beautiful violet color will appear when acetone is present, the intensity of the color being proportionate to the quantity of acetone contained in the urine.

Chautard's Test. — Romine recommends, as a reliable test for acetone in the urine, a solution of fuchsin (1 to 2000) into which a current of sulphurous-acid gas has been passed. This rapidly decolorizes the liquid and causes it to assume a clear-yellow tint, which is permanent and unaffected by an excess of acid. A few drops of such a solution, added to a urine containing acetone, produce a deep-violet color. The test is delicate enough to allow the detection of one part of acetone in one thousand of urine.

Definite Tests for Acetone.—When no very great quantity of acetone is found in the urine it is absolutely necessary to distill the urine and to test the distillate with the different reagents. The distilla-

tion of two hundred to three hundred cubic centimetres of urine is made in a water-bath, and a temperature of 56° to 58° C. is employed. No acid need be added to the urine before distillation, as the acetone becomes distilled very well without acid and the acid might disintegrate other substances present and thus cause the formation of acetone. There is no reason why special care should be taken lest a small amount of ammonia be distilled with the acetone. The distillation is only continued until a sufficient quantity of fluid for the different tests to be employed has passed over into the recipient. The distillation is then subjected to the following tests:—

Lieben's Iodoform Test.—To a few cubic centimetres of the distillate a few drops of a solution of potassium and some drops of a solution of iodine and iodide of potassium are added, the solution of potassium being added in excess. When acetone is present, a thick, yellow precipitate of iodoform will immediately form. This test will reveal 0.01 milligramme. By heating, the iodoform evaporates and accumulates on the sides of the test-tube in the form of small yellow plaques, consisting of the characteristic crystals of iodoform. The most serious objection to Lieben's test is that many (at least seventeen) other substances, and especially alcohol, may give the same result.

> Lieben's iodoform test recommended both for delicacy and ease of application. A yellow opacity, with precipitation of iodoform, occurs if acetone be present. Nothing else that occurs in the urine, except acetone, is able to give this precipitate of iodoform, without warning. When but small quantities are present the urine should first be made acid with sulphuric acid and distilled. When half the urine has been distilled all the acetone has been found to be in the distillate. Ruttan (Montreal Med. Jour., Mar., '91).
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> The most satisfactory test for acetone in the urine is Lieben's. It is performed by adding a few drops of Lugol's solution to the first 10 cubic centimetres obtained by distilling 400 cubic centimetres of fresh urine, then adding sodium-hydroxide solution until the brown color disappears. In the presence of acetone a milky precipitate of iodoform is produced, and may be recognized by its violet coloration with caustic soda and thymol, or by its yellow hexagonal crystals under the microscope. Ronsse (Annales de Gyn. et d'Obstét., Mar., 1900).

Gunning's Test.—Gunning modified Lieben's test by using a solution of ammonia and tincture of iodine. Le Nobel prefers to use a solution of ammonia and iodine dissolved in iodide of ammonium; this certainly is the best way to make the iodoform test, as no alcohol is added with the reagents. According to le Nobel, 0.001 milligramme of acetone can be detected by this test, but von Jaksch could only detect acetone by it when present in a quantity of 0.1 milligramme. Errors caused by the presence of alcohol are avoided by this test.

Reynold's Test. — Freshly precipitated oxide of mercury is dissolved by acetone in the presence of alkali. Le Nobel prefers to make the test by precipitating a solution of perchloride of mercury with an alcoholic solution of caustic potash, added until the mixture gives a strong alkaline reaction; then the fluid containing acetone is added and the whole well shaken in a test-tube. The fluid is then filtered and care taken that the filtrate be perfectly limpid. The combination of acetone and oxide of mercury in the filtrate can be detected by chlorate of stannum or by floating some drops of the filtrate on a solution of sulphide of ammonium: where the two liquids touch each other a black ring

will appear. By means of this test 0.01 milligramme of acetone is revealed, and the test is at once very delicate and very reliable.

The Nitrocyanide Test.—This test is made with the distillate quite in the same manner as with the urine either after the method of Legal or after le Nobel's modification of it. This test is less delicate, and the phenols, which possibly might have passed over into the distillate, are apt to give the same color as the acetone; the test, therefore, gives no proof of the presence of the latter substance.

Penzoldt's Indigo Test. — Baeyer and Drewsen found that acetone forms indigo blue with orthonitrobenzaldehyde. Penzoldt has employed this reagent by dissolving urine crystals of orthonitrobenzaldehyde in boiling water; on cooling down the aldehyde forms a white, milky cloud; the fluid which is to be tested is now added and the mixture rendered alkaline with a solution of potash. When acetone is present a yellow color will appear, which changes to green and, after ten minutes, to indigo; it also forms an indigo-blue precipitate. Very small quantities of acetone may be detected by shaking the mixture with a few drops of chloroform. When left quiet for some time the chloroform takes a blue color and sinks to the bottom of the test-tube.

According to Penzoldt, acetone is revealed by this test in a solution of 1 to 2000. According to von Jaksch, the smallest quantity of acetone revealed by it is 1.6 milligrammes. Aldehyde acetophenone and other substances form indigo in the same way as acetone, but the color is not so marked.

Malerba's Test. — Malerba found that a $^1/_2$-per-cent. solution of paramidochmethylaniline with acetone gives a reddish color, changing into violet and blue-red.

> The violet color changes to rose and the next day to red. Under the spectroscope two stripes are seen analogous to those of hæmoglobin. The test is also good for uric acid, the solution of the latter being left to evaporate, and when the residue is fairly dried some drops of the above solution added, when a blue coloration is obtained. Malerba (Revue des Sci. Méd. en France et à l'Etranger, Apr. 25, '95).

Miscellaneous Tests.—With bisulphite of soda, acetone, as well as the aldehydes, combines to a crystallic compound in thin flakes resembling much those of cholesterin, even by microscopical examination. (Limpricht.)

Acetone in an alkaline solution combines with iodine to form iodoform.

Freshly precipitated oxide of mercury is dissolved by acetone. Indigo is formed when acetone is combined with orthonitrobenzaldehyde in an alkaline solution. (Baeyer and Drewsen.)

> Bichloride of mercury recommended as a reagent for acetone and albumin, as well as for the estimation of the quantity of glucose and nitrogen present in the urine. Pittarelli (Gl' Incurabili Gior. di Clin. e di Terapia, Nos. 16 and 17, '94).
>
> Certain substances (sugars) yield the reactions usually characterizing acetone. This is due to decomposition of sugar and formation of acetaldehyde. In testing by the ordinary method, the urine should, therefore, be moderately acidified and distilled slowly and not too long. Salkowski (Jour. de Méd., de Chir., et de Pharm., Bruxelles, Jan. 26, '95).

From what has just been stated it will become apparent that none of the tests are specific for acetone alone. To be quite sure that acetone is contained in the distillate, it is, therefore, necessary to try successively by all the tests, and only when all tests give positive result is the presence of acetone proved.

Von Jaksch has tried to employ the

nitrocyanide test for a quantitative estimation of the acetone, and the iodoform test has been recommended by Messinger and Huppert for the same purpose. The quantity of iodine used to form iodoform with the acetone is measured, and the quantity of the acetone present in the solution calculated by it also; but, although Engel and Devoto are of the opinion that it is possible to make pretty accurate estimations in this way, methods for quantitative estimation of the acetone are not to be relied upon, as it is impossible to avoid errors caused by the presence of substances which are influenced by the tests in the same way as the acetone.

Diacetic acid ($C_4H_6O_3 = CH_3—CO—CH_2—COOH$) may be revealed in the urine by the aid of a solution of perchloride of iron, which, with diacetic acid, produces a dark, wine-red color. The test is made by adding a solution of perchloride of iron as long as a precipitate of phosphates of iron is formed. The mixture is then filtered and some drops of perchloride are added to the filtrate. When diacetic acid is present, the filtrate takes a deep-red color, which vanishes in twenty-four hours, and more rapidly after addition of strong acids. Von Jaksch has, by a colorimetric method based on this test, tried to make an approximate estimation of the quantity of diacetic acid contained in the urine, but newly-passed urine can alone be used for the search of diacetic acid, as this acid, after some time—twenty-four to forty-eight hours—will disappear from the urine. Diacetic acid can be isolated from the urine by adding a few drops of sulphuric acid and shaking the mixture with ether. When diacetic acid is present, it is dissolved in the ether and can be detected by the perchloride-of-iron test.

Beta-oxybutyric acid ($C_4H_8O_3$) is also found sometimes in the urine of fever patients, as well as in diabetes, with acetone and diacetic acid. This may also be the case in the dyspepsia of alcoholism and in carcinoma of the stomach. When beta-oxybutyric acid is cautiously oxidated, acetone is found.

F. Levison,
Copenhagen.

ACETO-ORTHO-TOLUIDE. — Aceto-ortho-toluide is an isomer of exalgin, and appears in the form of colorless needles, freely soluble in alcohol, ether, and hot water, but little soluble in cold water. Its melting-point is 224.6° F. and boiling-point 564.8° F., being comparable in these respects to acetanilid and methylacetanilid, which it resembles chemically, being also, like these drugs, an active antipyretic.

Physiological Action. — Aceto-ortho-toluide acts chiefly on the cord, and only in toxic doses on the brain and medulla. The heart is last affected. Doses of $^3/_5$ grain per kilogramme of the body-weight reduce normal temperature by about $1\,^1/_2°$ F., and bring febrile temperatures to the normal point. It does not alter the blood-pressure, but somewhat increases the frequency of the heart-beats, though leaving the vasomotor centres unaffected. It causes dilatation of the blood-vessels by direct stimulation of the nervous elements of the vascular walls themselves. The fall of temperature is, moreover, due to the loss of heat consequent on this dilatation. (Barabini.)

Therapeutics.—Although this product was introduced as one superior to acetanilid, owing to its being less toxic, it does not seem to have received much support from the profession. It was also credited with antiseptic properties even in a weak solution (5 to 1000).

ACETYLENE.—When calcium carbide (CaC_2) is brought in contact with water, acetylene-gas is formed. Being capable, when lighted, of furnishing a degree of light far superior to that of ordinary gas, acetylene has recently been considerably used as an illuminant. When prepared from pure calcium carbide and purified by liquefaction, it has a pleasant ethereal odor and can be breathed in small quantities without giving rise to ill effects. Impure gas, prepared from coal or impure lime, may contain calcium sulphide and phosphide, and the acetylene prepared from it may then have a very unpleasant odor.

Acetylene Poisoning.—Acetylene may be fatally poisonous when present in proportions as high as 40 per cent. by volume, as recently shown by Gréhant, Berthelot, and Moissant. A mixture of 20 volumes of acetylene—prepared from calcium carbide, 20.8 volumes of oxygen, and 59.2 volumes of nitrogen—was breathed by a dog for thirty-five minutes without any marked disturbance, and 100 cubic centimetres of the blood were found to contain 10 cubic centimetres of acetylene. With 40 volumes of acetylene, the proportion of oxygen remaining the same, a dog died in less than an hour, owing to failure of the heart's action, and 100 cubic centimetres of blood contained 20 cubic centimetres of acetylene. With 79 volumes of acetylene and 21 volumes of oxygen the poisonous effects were still more strongly marked.

The poisonous action of acetylene itself is feeble when the blood is at the same time supplied from the air with the usual amount of oxygen. In other words, acetylene inhaled in the open air is but slightly harmful.

One hundred volumes of blood dissolve about eighty volumes of acetylene; the solution shows no characteristic spectrum, and is reduced by ammonium sulphide as readily as ordinary arterial blood. In a vacuum part of the acetylene is evolved at the ordinary temperature and part at 60° F. If the blood is allowed to putrefy, the volume of acetylene given off at the ordinary temperature remains practically the same, but the quantity liberated at 60° decreases as putrefaction advances. If any compound of acetylene and hæmoglobin is formed, it is very unstable, and is not analogous to carboxyhæmoglobin. Brociner (Boston Med. and Surg. Jour., July 30, '96).

In a closed room, however, where the oxygen is not kept up to the normal standard, when the accumulation of a foreign gas would prevent the constant renewal of air through window and door interstices or open chimneys, and where the products of respiration would be allowed to accumulate, it would quickly prove mortal by paralyzing the respiratory function.

Experiments on dogs, guinea-pigs, and other animals showing that acetylene has considerable toxic power. One pint of the pure gas caused severe symptoms of poisoning in dogs, and even when mixed with air (20 per cent.) it proved fatal after an hour. If the gas was administered rapidly, the animals recovered when placed in the open air, but if given slowly this did not occur, and the animals died. Mosso and Ottolenghi (Rif. Med., Jan. 23, '97).

A mixture of air and acetylene commences to be explosive when it contains 5 per cent. of acetylene, whereas it requires the presence of 8 per cent. of coal-gas to make a similar mixture explosible. If a rabbit is placed in a bell-jar into which ordinary air and acetylene are pumped, the animal seems for a long period to experience very little inconvenience. It is not until ordinary atmospheric air is excluded and only acetylene admitted that symptoms gradually and slowly develop. After a more lengthened exposure to acetylene than that which is necessary for coal-gas the ani-

mal becomes intoxicated, it falls over on its side apparently profoundly asleep, and, while all through the experiment its breathing has been somewhat short and rapid, stupor steals over the animal apparently painlessly. A few inhalations of atmospheric air are sufficient to restore to the animal all its faculties. Should inhalation have been pushed further and the animal have been very deeply asphyxiated, death may ensue, cyanosis, hitherto observed, being rapidly replaced by extreme pallor. In minor and easily-recoverable stages of asphyxia the vascular tension is still maintained, and there is no difficulty in obtaining a drop of blood for examination; but when the deeper stages are reached so extremely contracted are all vessels that it is almost impossible to obtain even a trace of blood. When this stage has been reached recovery is difficult. When blood of a rabbit was examined at different stages of intoxication from acetylene, and especially in deepest asphyxia, this fluid on spectroscopic examination always exhibited two well-marked bands of oxyhæmoglobin; also that, unlike the blood in coal-gas poisoning, although resembling it in the cherry-red color which it presented, it was readily reduced on the application of ammonium sulphide and gentle heat. Thomas Oliver (Brit. Med. Jour., Apr. 23, '98).

It has been said that acetylene is very poisonous; the experiments of many observers, and especially those of Gréhant, do not confirm this statement. He proved that acetylene simply dissolves in the blood-plasma, while carbon monoxide forms a compound with the hæmoglobin of the blood. Acetylene, while slightly poisonous, is less poisonous than coal-gas, and vastly less than water-gas, which contains a high percentage of carbon monoxide. E. Renouf (Pharm. Era, July 20, '99).

Treatment of Acetylene Poisoning. — That fresh air should at once be given the patient need hardly be mentioned. The patient should be removed from the poisoned atmosphere into a well-ventilated room and artificial respiration practiced. Hypodermic injections of strychnia and digitalis should be administered, while oxygen is sent for. This gas should be inhaled as soon as practicable, while artificial respiration is continued with vigor, the patient being simultaneously rubbed. Rectal injections of warm coffee are also useful.

In all such cases the efforts of the physician should be kept up a long time, the respiration and pulse being unreliable guides as regards the presence in the system of sufficient life to render resuscitation possible.

Therapeutics.—Acetylene has not been used in therapeutics.

ACNE.

Definition. — Acne is characterized by the presence, on the face, of small elevations or nodosities varying in size from a pin-head to a pea. These elevations, or pimples, are also present on the back, shoulders, and chest in many cases.

Symptoms. — The elevations are conical or hemispherical, and, as a rule, in the earliest stage of the lesion somewhat painful, especially upon pressure. In most of the lesions there is a distinct tendency to suppurative change. In the centre of the lesion a whitish-yellow spot forms where the pus raises the epidermis. In from three to ten days, or even longer, the lesion breaks and a small amount of pus is discharged. At other times the pus dries to a thin crust, or occasionally the contents, especially in sluggish lesions, are absorbed. A red elevation is left which gradually flattens out, leaving a brownish stain, which eventually disappears. The surrounding skin is frequently oily and shiny. Tumors as large as a pea or a small nut, formed by retention-cysts of sebaceous glands, are sometimes seen; they may gradually work to the surface or may persist for

months and finally disappear or form hard spherical indurations by retraction and inspissation of their contents. Scarring, usually consisting of small, white, cicatricial depressions, is to be seen as a consequence in some cases. In the majority of cases, however, permanent marks are not left. The regions most affected in acne are the face, shoulders, and anterior and posterior aspects of the shoulders. Occasional cases are observed in which the back, extending as far down as the sacrum, is the chief seat of the disease. In rare instances (acne cachecticorum, acne scrofulosorum, and acne medicamentosa) the eruption may be more or less general.

Varieties.—There are several varieties of lesion observed in acne, one kind of which is apt to predominate, and this has given rise to the so-called varieties of the disease.

Acne vulgaris, or acne simplex, is, by far, the most common clinical type. The lesions are usually of a mixed character, consisting of black-heads, pin-head to pea- sized papules, papulo-pustules, and pustules. Each lesion may in its beginning have a small, red areola. There is also slight pain upon pressure. The lesions are rapid in evolution, running a course in several days to a week. As in all types, they are discrete and isolated.

The term "acne papulosa" is given to a not uncommon type in which the lesions are usually small and show but little disposition to reach the pustular stage, disappearing by absorption or by desiccation and exfoliation.

Acne punctata might be termed minute papular, the lesions being, for the most, pin-head in size, with a central comedo, or black-head.

Acne pustulosa is another type in which the lesions go rapidly into the pustular stage, the eruption appearing, for the most part, to be made up, almost entirely, of pustules. In size they vary from a large pin-head to a large-sized pea. "Acne indurata," or "tuberculosa," is a form of the eruption in which the lesions tend to be closely crowded here and there and in such places, and also with single lesions, the underlying base becomes hard, inflamed, and indurated, being also somewhat deep-seated.

In acne phlegmonosa the inflammatory and suppurative process begins deep down in the sebaceous gland, forming veritable small dermic and intradermic abscesses, usually with but slight tendency to break through the surface.

Acne cachecticorum characterizes an acneic eruption, more or less general, occurring in weak, cachectic individuals; the lesions are livid, indolent, violet-red papulo-pustules of moderate and large size and of slow evolution, leaving, as a rule, small cicatrices. Acne scrofulosorum is really a variety of the last named, — acne cachecticorum, — occurring in those of distinctly strumous or tuberculous temperament.

> Severe case of acne scrofulosorum in girl with no tubercular family history, but with enlarged cervical glands. Acneic pustules and comedones extremely numerous, developed in crops, suppurated freely, left deep livid-blue scars, most noticeable over buttocks and thighs. J. J. Pringle (Brit. Jour. of Derm., Apr., '95).

> Five cases of acne scrofulosorum in infants. Clinical features: an indolent, small papulo-pustular or acneiform eruption, occurring in infants, sparsely disseminated and not grouped, unaccompanied by subjective symptoms. It affects chiefly the extremities, the lower in particular, and their extensor surfaces. The buttocks and regions above are often involved. The lesions appear successively or by subacute outbreaks. The papules develop about the hair-follicles and become successively pust-

ular and crusted. When the crust with a central plug is lost, a flattened, crateriform, irregular lesion, like those of lichen planus, is left. After complete involution, a stain or faint scar remains. T. Colcott Fox (Brit. Jour. of Derm., vol. vii, No. 11, p. 341, '95).

Acne artificialis seu medicamentosa is a form of acneic eruption produced by the ingestion of certain drugs, as the iodides and bromides, and also by the external applications of certain remedies, such as tar, the paraffin-oils, etc.

An artificial type of acne may be seen on the chest, abdomen, and back, the cheeks, forehead, and chin being affected in those who are taking iodide, while the chin is covered when the cause is either menstrual or intestinal. That associated with rosacea begins around the nose. In the cachectic type or in those who are hard students or of a nervous temperament it is more frequently witnessed on the forehead. Those who present lesions upon the entire face are generally found to suffer from habitual constipation. The treatment should be based upon these facts. Dyer (New Orleans Med. and Surg. Jour., June, '94).

"Acne atrophica" is a name given to those cases of acneic eruption which tend to leave depressed scars. This probably occurs most frequently in those cases in which the lesions are sluggishly papular or papulo-pustular, the lesions disappearing by absorption or crusting and leaving behind small punched-out cicatrices.

Acne hypertrophica is really the opposite of the last-named variety, and occurring in about the same kind of cases, small, whitish, connective-tissue pin-point or small-pea sized projecting hypertrophies marking the sites of the lesions. It is rare.

Etiology. — Acne begins usually near puberty, when the pilar system is more actively developing, and the functions of the sebaceous glands likewise; and is more frequent among patients with digestive troubles, constipation, dilatation of the stomach, menstrual irregularities, the strumous diathesis, possibly the arthritic diathesis, and disturbances of the nervous system.

Anæmia, dyspepsia, constipation, amenorrhœa, and dysmenorrhœa are all exceedingly common functional derangements or disorders occurring simultaneously with acne, but no more a cause of it than of psoriasis and scabies. Stephen Mackenzie (Brit. Jour. of Derm., Oct., '94).

Constipation is a most important factor. That nerve-influence considerably affects acne may be witnessed during menstruation and dyspepsia. Stopford Taylor (Brit. Med. Jour., Oct., '94).

It has been also alleged that lesions of the genito-urinary organs and venereal excesses may provoke the disease. Lesions may be due to mechanical irritation caused by the product of secretion remaining in the excretory canal or gland itself. Some drugs, as already stated, — such as the bromides and iodides, — are occasionally responsible for the eruption or an increase in an already existing eruption. Certain drugs applied externally may also provoke acneic lesions, such as tar and tar products, juniper-oil, and the like. Workers in paraffin and paraffin products will not infrequently be found affected with papules and pustules, especially those of a furuncular or abscess type.

Professional form peculiar to workers in paraffin; eruption papular, furunculous, or acneiform; affects hairy portions of the skin. Gervais (Thèse de Paris, '95).

[As in artificial eruptions, individual predisposition here naturally plays a most important rôle. L. Brocq, Assoc. Ed., Annual, '96.]

Stubborn indurated and pustular acne witnessed in persons exposed to chlorine-vapor. The condition is analogous to iodine and bromine acne. Treatment is

very unsatisfactory. Herxheimer (Münch. med. Woch., Feb. 28, '99).

Pathology.—In most cases the process begins by a perifolliculitis, which later on gives rise to a purulent folliculitis. It would thus seem that the sebaceous glands play but a small part in the affection. In some cases, however, when comedones are present, the sebaceous gland itself is the starting-point of the inflammatory process. (Brocq.)

Even when the focus of irritation is in the follicle, it is frequently limited to the sebaceous or sebaceous pilary canal. (E. Besnier, A. Doyon.)

The papillæ surrounding the comedone and the superficial layers of the corium are filled with blood-vessels full to repletion, and of exudation cells which are found in dilated vacuoles. (Kaposi.)

If the process is very intense, the sebaceous gland may be entirely destroyed by the local inflammatory action, while the pilar bulba persists. (Kaposi.)

The acneic process may be divided into two parts: 1. Closure of the sebaceous follicle and formation of comedo. 2. Suppuration, which only occurs in those follicles where the staphylococci aureus et albus have penetrated before the comedo formed. (Unna.)

In true acne the bacillus described by Unna is invariably present. It always occupies the same portion of the comedo,—namely, the bottom of the central cavity, only reaching the uppermost part in markedly developed comedones. Menahem Hodara (Jour. des Mal. Cut. et Syph., Sept., '94).

Bacteriological examination of comedones and pustules: The staphylococcus pyogenes albus is constantly present in the pustules of acne; there are also present occasionally a yeast-fungus and a bacillus, but always in small numbers. In the non-inflamed comedo there is an abundant development of microbes, the staphylococcus albus always being present. At the moment that inflammation occurs in the comedo a considerable diminution in the number of kinds of microbes occurs.

The skin of those not affected by acne is just as rich in microbic species as that of the acneic patient.

The presence of certain microbes is not sufficient to explain the occurrence of the malady. One cannot accept the theory of a specific cause in acne.

Unna's special bacillus is only a small virulent variety of the bacterium coli. Lomry (Derm. Zeit., B. 3, H. 4, '96).

Up to 1899 no observer had succeeded in obtaining the acne bacilli pure from lesions of acne vulgaris or comedo, and there was practically no proof that these bacilli were the cause of acne vulgaris. Definite bacilli (bacillus acnes), however, were found present in all smears taken from 240 typical acne lesions from 86 patients. Pure cultures were obtained from 62 lesions (chiefly acne nodules) from 29 patients. It is present as a short, thick bacillus in smears, but in culture often becomes much longer and thicker, and in old cultures assumes distinct branching forms. It is now definitely proven that this micro-organism is the primary cause of acne vulgaris. T. C. Gilchrist (Jour. of Cutan. Med., March, 1903).

Diagnosis. — Acne is to be differentiated from the papular, papulo-pustular, and pustular syphiloderms, and also from variola.

Syphilis.—In the syphilitic eruption the distribution is more or less general, and more acute in its outbreak, darker hued, and occurring occasionally with special groupings and the presence of other symptoms of the disease.

Variola.—In small-pox the premonitory constitutional symptoms, the sudden outbreak, the uniformity of the lesions, and many other symptoms of differential character will serve to differentiate.

Treatment.—In this connection acne may be divided into (1) an *irritable* or inflammatory variety, in which the skin is fine and thin and easily irritated by

stimulating applications, and where general treatment is important on account of the close union between the acneic eruption and various constitutional disturbances. Local treatment should, at first at least, be of a mild character. (2) An *indolent* variety, where the integument is thick, rough, and oily, with enlarged and obstructed gland-orifices, and where the most energetic local applications are well borne; here the local treatment is important. Probably most of the cases met with occupy a middle ground between these two extreme varieties.

General Treatment.—Prophylactic measures, such as the avoidance of external irritants, drugs and food liable to cause acne, such as coffee, tea, alcohol, pure wine, pork, veal, game too far gone, preserved fish, shell-fish, fats, and cheeses.

Increase in the solids of the blood causes an irritation of the sebaceous glands. Rapid cure is effected in these cases by increasing diuresis and local applications of a soap containing about 1 ½ per cent. of iodate and bromate of sodium. Bardach (Derm. Zeit., vol. ii, No. 2, '96).

Any disorder of digestion must be counteracted in order to avoid the congestion of the face following meals.

Attention to the condition of the alimentary canal and other disorders, as well as well-directed local treatment, is a quicker and more efficacious method than local treatment only. Radcliffe Crocker (Brit. Jour. of Derm., Oct., '94).

Acne can be cured with certainty and in a comparatively short time. The majority of cases are benefited by the tonic and aperient iron and magnesia mixture between meals, others by an alkaline bismuth mixture before food. In all cases an ointment which contains 30 grains of sulphur, 10 grains of ammoniated mercury, 10 grains of sulphide of mercury, and an ounce of vaselin should be used, oxide of zinc being added if there is much inflammation. Before its application the patient should bathe the face with hot water and a 10-per-cent. ichthyol soap well lathered on. An important part of the treatment is the careful application to each pimple of a minute drop of pure carbolic acid, just liquefied with a little water. P. S. Abraham (Lancet, Sept. 22, 1900).

If the tongue is much coated and shows prominent papillæ, the following is recommended:—

℞ Sodium bicarb., 10 grains.
Ext. of cascara sagr. liq., 10 to 20 minims.
Tinct. of nux vomica, 7 to 10 minims.
Peppermint-water, enough to make 1 fluidounce.—M.

After this has been taken for a week or ten days, if there is any indication for iron, a pill of reduced iron of 2 or 3 grains may be given after dinner or oftener.

Constipation should be counteracted by gentle aperients. Any condition capable of maintaining the sympathetic system in a state of tension—such as genito-urinary troubles or affections of the nasal fossæ—should be eradicated if possible.

If the patient is lymphatic and has a good digestion, codliver-oil is of value.

Much benefit obtained from syrup of lactophosphate of calcium in acne, especially when lumps are large. A favorable and palatable mixture when codliver-oil is required is the following:—

℞ Gum arabic, 10 drachms.
Water, 1 ounce.
Syrup of lactophosphate of calcium, 3 ounces.
Codliver-oil, 4 ounces.
Essential oil of bitter almonds, 3 minims.

The gum, water, and syrup should be rubbed together until a smooth mucilage is made, then the codliver-oil is to be added gradually, with constant stirring, and last the essential oil of bitter almonds. Made in this way, each table-

spoonful of the mixture contains 4 grains of lactophosphate of calcium and 50 per cent. of codliver-oil. H. S. Purdon (Dublin Jour. of Med. Sci., Feb., '98).

Anæmia or chlorosis call for the use of chalybeates with arsenic. Iron often does harm unless its constipating effect is counteracted by using aperients. When the patient is arthritic, alkalies, especially alkaline waters, are indicated.

No really specific treatment is known against acne, but the following have been recommended:—

Sulphur alone: powder or tablets, or with equal parts of honey.

Ichthyol (Unna):—

℞ Ichthyol, 1 to 2 drachms.
Dist. water, 5 drachms.

M. Sig.: Fifteen to fifty drops in water, to be taken morning and evening.

Ichthyol is very beneficial, both in acne vulgaris and acne rosacea. The best results are obtained when external and internal treatments are combined. In some cases of acne rosacea in which the skin is too thin and irritable to bear even weak solutions, the internal administration of ichthyol alone, with steaming, will be beneficial. Five grains of ichthyol may be given thrice daily after food, increasing the amount to 10 grains. Every night and morning the face is steamed for fifteen minutes, and is then washed with ichthyol soap. The lather is allowed to dry on the face, after which it is gently washed off with water. After each washing ichthyol salve, if it can be borne (often combined with ammoniated mercury), is applied. In acne vulgaris, after steaming, strong sulphur and ichthyol soap is used, with brisk rubbing with a flesh-glove. Brownlie (New York Lancet, May, 1901).

Arsenic bromide in weak doses, $^1/_{60}$ grain, in acne pustulosa. (Piffard.)

Mercurial preparations, such as corrosive sublimate or calomel, either alone or with jalap or colocynth extract, have been found useful.

Ergotine,—alone or with calcium sulphide,—digitalis, belladonna, hamamelis, and quinine have been recommended by Brocq. In stubborn cases iodide of potassium has been found efficacious.

Potassium iodide in doses of 5 grains, three times daily, recommended. It should be discontinued when local reaction occurs or iodine appears in the urine. When inflammation subsides, the treatment should be repeated. Ichthyol soap and sulphur ointment are to be applied in the intervals. J. Galloway (Practitioner, May, 1900).

Local Treatment. — Constitutional treatment will rarely succeed alone, while in a large proportion a local treatment by itself will be found efficacious.

In the prevention of acne in persons predisposed to the disease three things especially are to be done: 1. Remove superfluous sebum and epithelial accumulations in the ducts of the glands. 2. Stimulate the sebaceous glands into healthy activity. 3. Keep the skin aseptic, so as to prevent the pus-cocci from gaining admission to the follicles. The soaps with an alkaline basis are the most efficient as they are the most powerful. The most useful soaps are the sulphur, campho-sulphur, Peruvian-balsam, and creolin cake soaps; while, of the powdered soaps, the alkaline, brimstone, and creolin, and the neutral salicylic-acid-sulphur, and salicylic-acid-resorcin-sulphur soaps are the best.

When the disease is developed all comedones should be expressed and all pustules opened. Stimulating soaps or applications, or both, should then be used. Sulphur is the most important constituent of both. When there is very much inflammation around the acneic lesions soothing treatment is necessary, especially at first, while zinc oxide and calamin lotion and belladonna, locally applied, are sometimes of much service. When the more active lesions are remedied the preventive treatment comes into play, and it must be impressed on the patients that, unless they are willing to take the trouble to carry it out in a

thorough and continuous manner, they cannot expect to be free from acne. Stephen Mackenzie (British Journal of Derm., Oct., '94).

The x-ray treatment of acne meets the indications more satisfactorily than anything else. Relapse is not frequent as in older methods, and is slight. No burns of any serious degree are necessary during the treatment. If the treatment is not forced to the extent of a burn, there is probably no danger of atrophy of the skin. No reaction should be produced beyond a mild erythema, and this degree should be reached slowly. It is not necessary to produce an erythema, but if the treatment is carried to this degree the result will be hastened. The hair, eyes, and eyebrows must be carefully protected. A tube with a vacuum which will back up a two and one-half inch airgap, at a distance of from ten to twelve inches, with a current of from 2 to 5 ampères for five to ten minutes on the area treated will probably give the best results. In the average case, about three months' time and twenty to thirty treatments will be required to produce a cure. G. E. Pfahler (Jour. Amer. Med. Assoc., August 6, 1904).

There are three indications for the treatment of acne: The first is to improve the condition of the skin, the second is to remove the bacteria that may be present, and the third is to keep the skin surface aseptic as far as possible. The first indication can be best met by correcting all other diseases that may be present. This means that all hygienic precautions must be observed and care taken of all the functions of the body. For the removal of the bacteria, the writer has found the curette and the acne lancet of special importance. Where there are many lesions, they should be removed by direct curetting two or three times a week. All deep-seated lesions should be opened with the acne lancet, which possesses a shoulder that prevents it from sinking too deeply and thus giving rise to scars. Where acne lesions have not come to a head, slight pressure upon them brings out a white point. It is into this that the lancet should be plunged.

Lotions are better than ointments in the treatment of acne, because the skin is already more greasy than it should be in these cases. Sulphur has been found the best remedy, and the lotio alba gives excellent satisfaction. In cases where there is much tendency to seborrhœa, a resorcin wash is employed until the skin is shiny, and then zinc oxide used to lessen the irritation. The author has found that certain forms of sulphur soap can be employed with decided advantage. At first the simple washing is enough, but later the lather may be left on for some time.

Whenever the X-rays are employed, it must be with great care and only to the production of a slight burn, if even to this extent. G. T. Jackson (Med. News, July 1, 1905).

Hot water and alcoholic lotions sometimes act promptly. In mild cases these are applied at night with very hot water, either pure or combined with cologne-water or camphorated alcohol. The water is gradually reduced until pure camphorated alcohol or cologne-water is used. Boric acid or borax may be added to the lotions: 1 part to 50.

Hot oil, used as a wash, easily dissolves solid fatty matter. The comedones are dissolved and the skin softened preparatory to the application of sulphur. Lanolin should always be mixed with oil, vaselin, or benzoated lard. F. H. Barendt (Liverpool Medico-Chir. Jour., No. 38, 1900).

Instead of camphorated alcohol there have been used with success:—

Alcohol, 96°, saturated with boric acid, and alcohol with salicylic acid, 1 to 30. The latter is strong and must be used with care.

Mercurial lotions are efficacious in some cases, employed as follows:—

℞ Corr. subl., 1 part.
Alcohol, 90°, 100 parts.
Dist. water or rose-water, 150 parts.

At first this solution is weakened with one-half its quantity of water; afterward, if no irritation has resulted, the water is gradually reduced until the solution is employed pure.

Other mercurial preparations, in ointment form, such as the biniodide, the iodochloride, white precipitate, and mercurial plaster, viz.:—

> The ammoniated-mercury ointment, 5 grains or 30 grains to 1 ounce, of great value. Stopford Taylor (Brit. Jour. of Derm., Oct., '94).

> Face to be washed with water as hot as can be borne and some bland unirritating soap, and then, after carefully drying the skin, following lotion is applied once a day:—

> ℞ Hydrargyrum bichloridi, 12 grains.
> Spiritus vini rectif., 6 ounces.—M.

> Effect for first few days will be to render condition worse; but, after this, lotion prevents perforation of pustules. G. Gorden Campbell (Montreal Med. Jour., Apr., '98).

Formaldehyde has recently been tried with success.

Sulphur preparations are especially useful when much seborrhœa exists. In a few patients sulphur preparations cannot be used, owing to the irritation caused. Sulphur may be employed in the following ways:—

Sulphur-soap: with hot water, the suds being allowed to dry on to the face.

Sulphur-baths.

Sulphur-lotions: hot water with 10 to 60 drops for every one-half glass of liquid potassium polysulphide.

An effective method of using sulphur is the following:—

After washing with hot water and soap, the following mixture is applied with a camel's-hair brush:—

℞ Precipitated sulphur,
Potassium bicarbonate,
Glycerin,
Laurel-water,
Alcohol (60°), of each, 2 drachms.
—M.

The coating is left on during nighttime and washed off in the morning with an emulsion of almond-oil, and the skin is covered with oxide-of-zinc or bismuth-subnitrate ointment powdered over with fine starch.

When the skin becomes irritated, the sulphur paste should be discontinued and the zinc ointment applied alone until the irritation has disappeared.

The following are useful:—

℞ Sulphate of zinc,
Sulphuret of potassium, of each, 1 drachm.
Water, 4 ounces.

℞ Precip. sulphur, 4 drachms.
Ether, 4 drachms.
Alcohol, enough to make 4 fluidounces.

℞ Precip. sulphur, 2 drachms.
Gum tragacanth, 20 grains
Camphor, 20 grains.
Lime-water, 2 fluidounces.
Water, enough to make 4 fluidounces.

Sulphur ointments are usually made in the proportion of 1 in 10, with benzoated lard, simple cerate, vaselin, vaselin and lanolin, lanolin and sweet almond-oil or olive-oil, or castor-oil and cacao-butter.

To the sulphur may be added oxide of zinc in equal parts; borax, 1 to 20; salicylic acid, 1 to 50; naphthol, 1 to 10 or 1 to 20; resorcin or camphor, 1 to 20 or 1 to 40. They may be perfumed with essence of rose, bergamot, or balsam of Peru if desired.

Sulphur soaps are sometimes more convenient.

The following may be used:—

Soap and precipitated sulphur, equal parts.

Soap, precipitated sulphur, and juniper-oil, equal parts.

Soap, precipitated sulphur, and lard, equal parts.

Naphthol may be added to the first of the series.

> The "scaling" method by the various medicated soaps advocated. The soap is applied by lathering well into the skin, and then partly removing it with lukewarm water, and allowing the remainder to dry into the skin. The soap containing some combination of resorcin, salicylic sulphur, and balsam of Peru (Eichhoff) gives the best results. Julius Müller (Dermat. Zeitsch., Nov., '99).

Among other local treatments recommended are the application to the pustules of tincture of iodine, carbolic acid, nitrate of silver, salicylic acid, or resorcin. An ointment of ichthyol, 1 to 4 or 1 to 8, is also useful.

> Resorcin has been made use of in the treatment of ichthyosis and acne. W. Allan Jamieson (London Lancet, Sept. 12, '91).
>
> Results following the application of pure carbolic acid to each pustule most satisfactory. Very bad cases are soon benefited if the applications are carefully made. P. Abrahams (Brit. Jour. of Derm., Oct., '94).
>
> Resorcin-sublimate paste of great value. Unna (Brit. Jour. of Derm., Oct., '94).

The following resorcin paste is recommended:—

℞ Resorcin, 2 1/2 to 5 parts.
Zinc oxide,
Starch, of each, 5 parts.
Vaselin, 12 1/2 parts.—M.

This paste may remain on a day and a night and then be removed with a piece of cotton. Cure is said to be speedy, occurring in three or five days.

Salicylic acid acts well in from 1 to 2 1/2 per cent. in various ointments.

> Combination of the iodides and bromides of potassium with soap, the latter possessing keratolytic qualities. Two varieties: strong soaps containing from 2 to 6 per cent. of sodium iodide and from 1 to 3 per cent. of potassium iodide; weak soaps, containing but from 1 to 3 per cent. of potassium iodide and bromide. Useful to allow suds to dry upon site of application. Bardach (Lyon Méd., June 23, '95).
>
> [New treatments should be used with much prudence and with due thought to the susceptibility of the patient; there is a tendency to reject preparations of the iodides and bromides in acne, because these substances cause acne in many persons; yet in some rare cases I have personally noted improvement in acne to follow the use of minute doses of sodium or potassium iodide and of applications of tincture of iodine; it must never be forgotten, however, that idiosyncrasy may play a most important part in any medication. L. Brocq, Assoc. Ed., Annual, '96.]

Electrolysis has been recommended for the removal of the indurated masses left on the skin.

In acne of the back the strongest applications, as a rule, are demanded. Of especial value in some cases is the liquor calcis sulphuridis (Vleminckx's solution). This should be used at first diluted.

Massage of the face has recently been recommended.

> Massering-ball for use in the local treatment of acne. A ball set in a steel socket, the small sphere rotating within the cup of the latter, as in the ordinary ball-and-socket joint. The skin is first operated upon with disinfected needle and comedo-extractor, until all pustules and subepidermic foci are emptied. The surface is then rendered aseptic with a solution of formalin (40 per cent. of formic aldehyde), 1/2 per cent. to 2 per cent., according to the sensitiveness of the

patient's face. The massering-ball then rotated freely over the surface, and deep pressure made upon the affected region. James Nevins Hyde (Jour. Cut. and Genito-Urin. Dis., Mar., '96).

Before undertaking the local treatment of acne it is well to open the pustules, empty the comedones and sebaceous cysts, etc. Other direct surgical measures consist in cauterizations with the hot needle or electrolytic needle or in scarifications. These are often satisfactory in indurated and rebellious acne.

The galvanocautery recommended in acne. Infiltration anæsthesia is produced, and a cautery needle, similar to that employed in epilation, is introduced to a depth of about two millimetres. Bloebaum (Deut. med. Zeit., No. 52, '98).

Ichthyol is particularly beneficial both in acne vulgaris and acne rosacea. In the former strong external applications

Massering-ball. (*J. Nevins Hyde.*)

can be borne, but in the latter much weaker strengths must be used. The best results are obtained when external and internal treatment are combined, and in some cases of acne rosacea in which the skin is too thin and irritable to bear even weak solutions the internal administration of ichthyol alone with steaming will suffice to effect a cure. The general plan of treatment is to begin with 5 grains of ichthyol thrice daily after food, increasing to 10 grains. Every night and morning the face is steamed for fifteen minutes and then washed with ichthyol soap made into a lather and allowed to dry on, which is then gently washed off with water. After each washing, if it can be borne, ichthyol salve (often combined with ammoniated mercury) is applied. In acne vulgaris, after steaming, strong sulphur and ichthyol soap is used, with brisk rubbing by means of a flesh glove. The diet is regulated. Ichthyol itself relieves mild cases of constipation, but, if it does not, a compound pill of iridin and euonymin or podophyllin may be given. Alexander Brownlie (N. Y. Lancet, May, 1901).

Exposure to Roentgen rays causes atrophy of the cutaneous follicles and checks pus-formation. Series of personal cases with interesting results. Case I, aged 22, treated for hypertrichosis, but had moderately severe acne simplex. The lesions were usually indolent, inflammatory papules without much induration and rarely with the formation of well-marked pustules. She was exposed to the x-rays for three months, with a production of some dermatitis, and she has been under similar treatment at intervals during the year. After the development of the first erythema her acne disappeared, and she had no lesions within the last year. Case II was practically identical with Case I. Case III, aged 26, treated for hypertrichosis, slight acne, comedones, and constantly recurring outbreaks of a few indolent, inflammatory papules. After the first erythema she has had no acne lesions. In all of the above cases the skin is smooth and soft, and the result is satisfactory from a cosmetic point of view. William A. Pusey (Jour. of Cutaneous and Genito-urin. Dis., May, 1902).

Treatment of acne by exposure to the x-rays tried in fifteen cases. With one exception, satisfactory results were obtained. The cases were not selected. R. R. Campbell (Jour. Amer. Med. Assoc., Aug. 9, 1902).

Henry W. Stelwagon,
Philadelphia.

ACNE ROSACEA.

Definition. — Acne rosacea is characterized by a chronic congestion of the face, causing vascular dilatations; and by changes in the cutaneous glands and tissues, giving rise to seborrhœa, inflammatory acne, and hypertrophic changes.

Symptoms.—The nose and malar eminences are especially prone to this disorder. It may also affect the forehead,

chin, the neighborhood of the alæ nasi, the cheeks, and less commonly the side of the neck. In women the chin is occasionally invaded.

There are three forms of acne rosacea.

The first is the *erythematous and telangiectasic.* It may be characterized by temporary congestive spots on the face, showing themselves especially after meals and in the evening. These spots may be accompanied by no other lesion. This form is usually present in connection with more or less seborrhœa, especially on the nose, which is generally very oily. Again, the erythematous variety may be characterized by small vascular dilatations on the nose or malar eminences, which dilatations develop gradually, unite with one another, and form a net-work. This net-work is uniform in hue at a distance, but near by may be seen to be formed of congested surfaces over which are spread vascular dilatations. This degree of the erythematous form is almost always accompanied by seborrhœa, enlarged nose, and dilated glandular orifices, especially in women toward the menopause and in wine-drinkers. (Hebra.)

The nose may become slightly violet-hued and be cold to the touch.

The second form is the *erythematous* acne, *or true acne rosacea.* In addition to the erythematous and congestive feature, there may be found in this variety a true acneic element: papules and pustules. In some cases the acne appears before the congestion. There is a congestive red base with fine vascular dilatations and papulo-pustules of various sizes, often resting on an indurated violet-red base.

In this variety there may also be increase in number and size of the vascular dilatations, increase in size and depth of the acneic indurations, and proliferation and hypertrophy of the derma.

The third form is the *hypertrophic* acne, or *rhinophyma.* In this variety the glandular orifices are much enlarged, while the glands themselves may be ten to fifteen times increased in size. The tissues around them proliferate, forming a variety of pachyderma. The nose may be red or violet-hued, covered with enlarged orifices, greatly increased in size, falling down to the chin. Its exterior may be mammillated. (Brocq.)

Two subdivisions of this form are rendered necessary by the difference in the pathology of each. The first, glandular, presents an embossed aspect, the hypertrophy being due especially to hypertrophy of the pilo-sebaceous glands; the second, elephantiasic, presents a smooth aspect, being due to chronic œdema; there are also vascular dilatations, with sclerosis of the derma. (Vidal and Leloir.)

Etiology. — Women suffer more than men from the erythemato-telangiectasic and acneic forms. Men only suffer from hypertrophic acne. It usually appears between 30 or 40 years. In women, rosacea develops usually at from 30 to 45 years, and increases decidedly toward the menopause, after which it may recede. It may also, however, develop at puberty. In young women and girls it is frequently due to chlorosis, dysmenorrhœa, or sterility. In some it recurs at each conception.

Some authorities claim that, among the constitutional causes (which affect women more than men), heredity plays an important part. The disease is said to be more frequent in children of arthritic subjects, or of those who may have suffered from acne rosacea.

Cold feet, urethral and uterine disturbances, and constipation are also recorded as causes of the disease. The cause of acne may be found in the

mouth or teeth and be unilateral if the cause is one-sided. (E. Besnier, Doyon).

Dyspepsia, neuralgia, hemicrania, working with the head inclined forward, and disease of the nasal fossæ are among the less frequent etiological factors (which affect men more than women), while high heat, overheated rooms, high wind, sea-air, cold, and cold water are occasional causes, especially in men. The disease may become started in people who for several years have indulged in excessive hydrotherapeutic treatment (Kaposi).

Certain occupations—such as those of coachman, baker, smith, fireman, glass-blower—may also become primary causes of the trouble. Indiscretion in diet and alcoholic beverages are well-known factors. According to Kaposi, in wine-drinkers the nose is bright red, in beer-drinkers it is violet, while in spirit-drinkers it is soft, large, and dark blue.

Pathology. — The vascular dilatations of the face have been considered by some authorities as due to circulatory troubles caused by compression of the veins in the cranial foramina.

A certain paretic condition of the vascular walls may often be looked upon as a cause. (Brocq.)

The cutaneous nerves of the region affected have been found normal by E. Besnier. According to Leloir and Vidal, however, there is congestion of the deeper venous net-work of the skin; dilatation of the same vessels and of the perifollicular vascular net-work, their walls being often diminished in thickness. There is also formation of new vessels.

Diagnosis. — Lupus Erythematosus. — The superficial, congestive variety shows a brighter and better defined redness; crusts or squamæ on the surface; sharper and more definite edges; greater sensitiveness to pressure; slight elevation above the surrounding surface. If any cicatrix be present, it is surely lupus erythematosus.

Circumscribed Congestive Seborrhœa. — In this disorder there is a limited extent of patches, shallower and more uniform redness, with crusts covering them.

Keratosis pilaris is recognized by its inframalar and preauricular location, and the file-like feeling, to the finger, of the erythematous and telangiectasic patches.

Sycosis Non-parasitica. — This is always an inflammatory disease of the hair-follicles and perifollicular tissues. There are numerous papules and pustules, each perforated by a hair, and often capped by a small circular scale. The upper lip and chin are sites of predilection. The affection is usually painful.

Congenital adenoma sebaceum also has a special location: the naso-genial furrow, the parts around the nose, mouth, and chin. It presents a mamelated aspect, and its predilection for early youth and its normal evolution serve to establish its identity.

Eczema. — Erythematous, or pustulopapular, eczema of the face may sometimes present diagnostic difficulties. In this disease, the more or less constant, and usually intense, itching, the serous or sero-purulent secretion, and the desquamation will suffice to establish the diagnosis.

Psoriasis of the Face. — Diagnosis is also frequently difficult in this disorder. The patches are better defined and are generally covered by silvery-white scales situated on a red base, which bleeds easily on scratching. The presence of typical psoriasic patches on other portions of the body is an important sign.

Chilblains.—Changeableness of the

lesions and pains are peculiar to this disorder.

Acneiform Syphilides. — Here the manner in which the elements are grouped, the long duration of their evolution, their tendency to ulceration, and consecutive cicatrix are important. Complete failure of acneic remedies is another diagnostic point.

Rhinoscleroma. — In this disorder there are hard or ivory-like masses imbedded in the nose.

Prognosis. — Acne rosacea does not always increase; it may remain stationary or even recede, especially in women after the menopause. It may also, however, assume malignancy, but this sequel is very rarely met with.

> Case of a man, 67 years old, with a well-marked hypertrophic acne of the nose; one of the masses having been removed by ligature, an epitheliomatous ulcer supervened, and the growth gradually took on epitheliomatous transformation. Matignon (Jour. de Méd. de Bordeaux, Dec. 6, '91).

Treatment.—As to general treatment, it is especially necessary to pay strict attention to the good condition of the stomach and intestines, by appropriate measures and suitable diet. Purgatives are absolutely necessary from time to time; laxatives should frequently be given and constipation should be avoided (Brocq).

Proper circulation of lower limbs should be insured by adequate clothing. Any abnormal condition of the genito-urinary tract or of the upper respiratory tract, especially the nose, should be corrected, while anything tending to cause congestion of the face, such as tight collars or stays, should carefully be avoided. Sedentary intellectual work, especially by gaslight, frequently aggravates these cases.

As a rheumatic diathesis is a dominant etiological factor, various alkalies have been recommended, especially bicarbonate of soda or the various alkaline waters.

Where the face is intermittently congested, quinine, ergotine, belladonna, digitalis, and hamamelis have seemed useful. These may be combined in a mixture, with or without the tincture of aconite-root. Vasoconstrictor drugs have but little influence.

Perchloride of iron, tannin, ergot, and tincture of hamamelis are recommended by E. Besnier and A. Doyon.

The following preparation is extolled by Brocq:—

℞ Quinine hydrobromate,
Ergotine, of each, 30 grains.
Belladonna extract, 6 to 12 grains.
Lithium benzoate, 30 grains.
Excipient and glycerin, q. s.

M. For forty pills.

Sig.: Two before each of the two principal meals.

Rhubarb or aloes may also be added if necessary.

Amyl-nitrite may be inhaled or taken internally by patients suffering from congestive attacks of the face. (Sidney Ringer.)

The local therapeutic agents are the same as in acne vulgaris; though some irritable varieties of acne rosacea exist, it is usually necessary to act with greater energy.

Hot water and mercurial preparations are often of value. Mercurial ointment may be rubbed in pure or weakened with lard, twice daily, according to individual susceptibility. (Hardy.)

The following has been employed by Bazin with success:—

℞ Mercury biniodide, 7 1/2 to 15 grains.
Lard, 1 ounce.—M.

Sulphur preparations are also useful; but, as the preparations should be strong enough to cause irritation of the integuments, it is well to use sulphur pastes mixed with green soap.

In cases of average intensity dermatologists frequently employ Vleminckx's solution, at first with 5 parts of water, then gradually making it stronger until it is used pure. It should be left on several minutes, and followed by very hot water.

Green soap gives the best result in obstinate acne rosacea, alone or when used in conjunction with sulphur, naphthol, or salicylic acid. It may be used as in acne vulgaris or spread on a piece of flannel; the latter is then cut out to fit the affected region, and left on as long as possible. When the irritation becomes too great, the application should cease and cooling preparations, such as the following, be used:—

℞ Salicylic acid, 7 grains.
Zinc oxide,
Bismuth subnitrate, of each, 30 grains.
Lycopodium, $^1/_2$ drachm.
Vaselin, 2 drachms.
Lanolin, 3 drachms.

Ichthyol does not seem to be as efficacious in acne rosacea as in some other varieties of acne (Brocq).

Unna recommends daily doses of $7\,^1/_2$ grains of ichthyol internally and lotions with ichthyol dissolved in water, washing with ichthyol-soap. Steam or sulphur-water douches, pyrogallic acid, and chrysarobin have also been used with good results. Turpentine has also been found efficacious.

Liquor gutta perchæ may be used to exert pressure on the vessels and thus encourage resolution of the parts.

A solution of iodine in glycerin, applied twice daily during three or four days, is recommended by Kaposi.

Treatment of acne rosacea is divided into constitutional and local. In women any menstrual disorder should be corrected, all alcoholic stimulants should be stopped, and good plain diet taken. If tongue is very coated alkaline bitter tonic should be ordered. When skin is much thickened, and there are many acne papules and pustules, German green soap is best, used with hot water, and a piece of white flannel, every night, until the skin begins to peel considerably. In less severe cases white Castile soap is good. Five-per-cent. resorcin soap (Eichhoff's) is very efficacious. Prescription for an ointment is as follows:—

℞ Sulph. præcip., 1 to 4 drachms.
Acidi salicyl., 10 to 30 grains.
Ol. amygdal. dulcis, 1 drachm.
Lanolin, 1 ounce.

M. Sig.: Apply at night after washing. (The salve should not be gritty, but perfectly smooth.) T. C. Gilchrist (Maryland Med. Jour., Dec. 10, '98).

Blisters, left on but four or five hours, are used by some dermatologists.

Surgical treatment in this disease is the most efficacious. (Brocq.)

Kummerfeld's solution, used in varying strength according to severity of case, will be found efficacious, especially in connection with scarification:—

℞ Sulph. præcip., 1 to 3 drachms.
Pulv. camph., 5 grains.
Pulv. tragacanth., 10 grains.
Aquæ calcis, 1 ounce.
Aquæ rosæ, 1 ounce.

M. Sig.: Apply after washing at night.

Scarification or the application of the electrical needle is a very necessary adjunct to the treatment.

Scarification can be done in three ways: 1. By linear scarification. 2. By slitting up the dilated cutaneous blood-vessels. 3. By puncturing rapidly. The third plan is best. T. C. Gilchrist (Maryland Med. Jour., Dec. 10, '98).

In typical acne rosacea the pustules are first emptied, then cauterized with a

fine-pointed thermo- or galvano- cautery. Vascular dilatations promptly yield to cauterization with a very fine point heated by electricity or a simple needle heated in the fire.

Electrolysis is another satisfactory method. A fine platinum needle is inserted alongside of the vessel, and, if possible, into it, and connected with the negative pole, while the patient holds in his hand a cylinder in communication with the positive pole. A large eschar must be avoided. (Hardaway.)

The ordinary galvanic or faradic currents have been recommended by Cheadle and Piffard.

Scarification is a favorite method. The best instrument is Vidal's ordinary scarificator. The skin is cut obliquely or perpendicularly to the vessels, then slightly obliquely across these so as to form lozenges, and as near together as possible (from one to one and a half millimetres apart), and not deep enough to penetrate entirely through the dermis, so as to avoid cicatrices.

An hour afterward the part is washed with a corrosive-sublimate solution, 1 to 1000; then in the evening or the following day compresses dipped into an ammonium-hydrochlorate solution, 1 to 100, or corrosive sublimate, 1 to 500, are applied. If too strong, warm water is to be added. If the reaction is too violent, starch-poultices, bland pomatums, or zinc-oxide plasters can be employed.

The treatment should be renewed in from five to eight days. Amelioration will occur in from eight to ten sessions; and marked improvement in from fifteen to twenty-five sessions.

Scarifying should be begun in the lower part of the region to be operated upon, in order not to be troubled by the blood covering the surface. (E. Besnier, A. Doyon.)

In the early stage of hypertrophic acne the scarification must be made deeper, and in many cases it is essential to also cauterize the glands deeply.

> If there are only a few large veins visible at the root of the nose, the writer merely pierces each of these with a galvano-cautery needle; but if there are many, he punctures the entire skin of the nose with points so close together that no vessel can be missed, to a depth of ½ to 1½ millimeters. The entire skin soon sloughs off, and the resulting raw surface is trimmed into shape as necessary by the cautery, and dressed with an antiseptic powder (bismuth, dermatol). The skin heals in about twelve days. This method has given better results than operations with the knife or electrolysis. Bolebaum (Munch. med. Wochen., No. 52, 1904).

Electrolysis of each dilated sebaceous follicle with a negative platinum needle and a current of from 4 to 6 milliampères is an effective, though tedious, measure. The needle should be moved around in the follicle in order to thoroughly destroy it. In the advanced hypertrophic form direct removal with the knife is the best procedure. (Brocq.)

Hypodermic injections of alcohol have recently been recommended. Phototherapy has likewise given satisfactory results.

> The light treatment of this form of acne should be included among the recognized therapeutical measures. It brings about a cure more rapidly than chemical means (salves, etc.), and is more quickly efficacious than it is in tuberculous or erythematous lupus. In most of the cases the cure remained perfect; in others, it became so when combined with external treatment, and with the necessary attention to the visceral disturbances, especially of the gastro-intestinal tract. M. Leredde (Jour des Prat., April 18, 1903).

ACONITE.—The preparations of aconite usually employed are obtained from

the root of the *Aconitum napellus* (monk's-hood): a conical tuber greatly resembling horse-radish. This resemblance has caused many deaths. When scraped, however, aconite-root does not emit the pungent odor peculiar to horse-radish. Again, instead of irritating the palate, as does horse-radish, aconite-root, when masticated, soon produces in the mouth a sense of warmth and tingling, soon followed by local numbness varying in duration according to the length of time the mucous membrane is exposed to the effects of the drug.

The active principle of aconite, aconitine, will be considered in the next article.

Preparations and Dose. — Aconite in substance is not employed, and the preparations made with the leaves are no longer official.

The tincture (tinctura aconiti rad., 1905 U. S. P.) is no longer stronger than the English or French tinctures. Dose, 3 to 10 minims, every three hours. Its effects should be closely watched, especially in anæmic and corpulent individuals and in those addicted to alcohol.

In prescribing the tincture, the 1905 U. S. P. should be specified, to avoid accidents.

The fluid extract (extractum aconiti fluidum, U. S. P.), $^1/_2$ to 2 minims, every three hours.

The solid extract (extractum aconiti, U. S. P.), $^1/_4$ to $^3/_4$ grain.

Physiological Action.—Within half an hour after its administration the drug commences to affect the general system, slowing and weakening the heart's action, lowering arterial tension, increasing the action of the skin and kidneys, and producing more or less muscular weakness in proportion to the amount taken. It causes a tingling sensation in the lips, extremities, and, perhaps, the whole body; it diminishes the rapidity and depth of the respiration, and causes disorders of vision and loss of tactile sensibility and sense of pain. According to Wood, aconite, when administered in sufficient dose, is a powerful depressant of the sensory nerve; and there is some reason for believing that the stage of nerve-paralysis is preceded by one of nerve-stimulation. Subsequently, however, its action on the spinal cord was further ascertained, and Bartholow states that aconite affects the sensory nerves before the motor. It paralyzes first the end-organs, next the nerve-trunks, and finally the centres of sensation in the cord. It also impairs the reflex function of the cord, but, doubtless, secondarily as regards the sensory paralysis. The power of voluntary movement, which continues after the cessation of the reflex functions, is finally lost, owing to the action on the motor centres of the cord, and subsequently on the nerve-trunks.

> Pyraconitine, obtained from aconitine by heating to separate a molecule of acetic acid, causes no tingling of the lips or tongue. It causes slowing of the heart, partly from vagus irritation, partly from depression in function of intrinsic rhythmical and motor mechanisms. After its administration activity of respiration is reduced (by central depression) to a degree incompatible with life. Neither muscular nor intramuscular nervous tissue is strongly influenced by pyraconitine, but the spinal cord is impaired in its reflex function, and there is a curious condition of exaggerated motility. Theodore Cash and W. K. Durstan (Brit. Med. Jour., Aug. 17, 1901).

When aconite is applied directly to the heart, the number and force of the beats are lessened, and its action is finally arrested in diastole. It lowers the blood-pressure and pulse-rate when given internally by a direct action on the heart itself. Bartholow concludes that it is a

direct cardiac poison, affecting its ganglia and muscle, and also a sedative to the vasomotor nerve-system. Hare calls attention to the fact that the fall in pulse-rate from poisonous doses is sometimes preceded by a quickening due to a condition of weakness and abortive cardiac action. All agree that it is a respiratory poison by direct action on the muscles of respiration, but that the heart ceases before the respiratory movements.

Aconite reduces the temperature when given in health. Bartholow tells of a medical student poisoned with aconite, in whom the temperature fell two degrees. It also increases the action of the skin and kidneys, and with the increase of water there is augmentation of the solids excreted. (F. E. Stewart.)

Aconite Poisoning. — The symptoms following the ingestion of a poisonous dose usually show themselves after a few minutes. The tingling, prickling, and numbness already mentioned rapidly extend from the mouth and fauces to the face, thence to the body. Speaking requires marked effort. Great prostration and muscular impotency follow, and the skin becomes cold and clammy, the perspiration covering the surface, and the cold tissues communicating to the hand an icy coldness. Muscular pains may be present in the early stages, especially in the face. There is usually experienced marked epigastric pain with nausea and vomiting. Later on, however, the nausea ceases, owing to paralysis of the stomach-walls.

The heart-beats are greatly reduced in number and power; the pulse is usually irregular, compressible, and slow, and so weak, at times, as hardly to be felt. The breathing is labored, irregular, and shallow, the number of respirations being at first decreased then increased. The temperature may be considerably lowered.

The pupils may be dilated or remain of normal size and react equally. The eyes may protrude or be sunken; therefore they afford no differential information as to the nature of the drug.

The mind is usually clear, and the patient calm, though apprehensive of impending death. Occasionally epileptoid convulsions occur. Spasmodic purging, the stools being sometimes bloody, and rectal tenesmus are frequently present.

Aconite causes paralysis of respiration and circulation, death usually being due to sudden arrest of the heart in diastole.

> Case of poisoning from tincture of aconite-root. Two doses of 1 minim each, given one hour apart, produced tingling, mild delirium, diplopia, and other indications of aconite poisoning. Frank Woodbury (Phila. Med. Times, Jan. 1, '90).
>
> Personal case of death following a minimum dose. There are many cases of individual intolerance, and syncope may occur in certain patients from small quantities. Ferrand (La France Méd., Dec. 8, '93).

Treatment of Aconite Poisoning. — Death in these cases usually follows exertion by the patient. He should, therefore, be kept perfectly motionless in the recumbent position even during emesis, his head being slightly turned and the dejections received on a towel. An important feature of the treatment is to keep the patient as warm as possible by means of warm blankets and hot-water bottles, taking care not to place the latter against the skin. The head should also be kept warm. If the patient is seen early the stomach-tube should be used at once to empty the stomach. If no stomach-tube be at hand, apomorphine, $^1/_{12}$ to $^1/_8$ grain, should be administered hypodermically, or some other active emetic, such as zinc sulphate, 15 to 30 grains, be given by the mouth.

Digitalis, sulphate of strychnine, and belladonna are the most effective remedies, but ether and ammonia should first be employed, owing to their great diffusibility. All these remedies should be used hypodermically, the stomach being unable to perform its functions. A drachm of ether, ammonia, brandy, or whisky should at once be injected, and, after a few minutes, tincture of digitalis, 15 minims; strychnine sulphate, $^1/_{20}$ grain; or tincture of belladonna, 10 minims, according to what the practitioner may have. The dosage should be regulated so as to reach the point of physiological action by frequently repeated doses. Nitrate of amyl may be given by inhalation, and warm, very strong coffee be injected into the rectum.

If the patient is seen when the stage of depression has begun through absorption of the poison, the stomach-pump should alone be used, emetics at this stage being liable to cause arrest of the heart's action. Tincture of digitalis, in 20-minim doses, should be injected hypodermically and repeated as required, besides the other measures indicated. Frictions under cover, the rubbing being directed toward the heart, serve a useful purpose.

Twenty cases, six of which were fatal, found in the literature of the last ten years:—

Case 1. Tincture, 7 drachms. Recovery. Emetics; morphine, $^1/_2$ grain; fluid extract of digitalis, 6 drops; strychnine sulphate, $^1/_{180}$ grain; brandy, 1 ounce; all hypodermically. By the mouth, 2 gallons of warm water; fluid extract of digitalis, 20 drops; coffee, 11 pints; whisky, 3 pints; extract nucis vomica, $^1/_2$ fluidrachm; Port wine, $^1/_2$ pint. P. F. Brick (Jour. Amer. Med. Assoc., vol. viii, p. 567, '87).

Case 2. About 8 drops of concentrated fluid extract. Recovery. Emetics, coffee, whisky (dessertspoonful). Heat. Friction and sinapism. T. H. P. Baker (Amer. Pract. and News, vol. iv, N. S., p. 122, '87).

Case 3. Fleming's tincture, $1^1/_2$ ounces. Recovery. Emetics, brandy, ether, digitalis, ammonia carbonate. Amyl-nitrite and warmth. C. C. Bradley (N. Y. Med. Record, vol. xxxii, p. 155, '87).

Case 4. Tincture, $^1/_2$ ounce. Recovery. Brandy by mouth and hypodermically. Ether. One quart of cold, black coffee. Heat and posture. S. Barnett (N. Y. Med. Record, vol. xxxii, p. 761, '87).

Case 5. Amount not known. Patient intoxicated at the time. Symptoms of acute poisoning. Recovery. Emetics, brandy, ammonia, and digitalis by the mouth. Sixty minims of tincture of digitalis hypodermically. Heat. Clara T. Dercum (Med. and Surg. Reporter, vol. lxi, p. 376, '89).

Case 6. Tincture, amount not known. Child, 16 months. Marked toxic symptoms. Recovery. Brandy and fluid extract of digitalis frequently repeated in spite of vomiting. Byron F. Dawson (Med. and Surg. Reporter, vol. lxii, p. 7, '90).

Case 7. Tincture, 2 drachms. Death. Benjamin Edson (N. Y. Med. Record, vol. xxxviii, p. 365, '90).

Cases 8, 9, and 10. Dr. Edson mentions certain other cases known of, but not treated by him, three of which died.

The amounts taken in these were from 1 to 4 drachms.

Case 11. Tincture (B. P.), 1 ounce. Death in sixty-five minutes. Mustard, lavage, heat, ether, and brandy subcutaneously. L. M. Whannel (Brit. Med. Jour., vol. ii, p. 791, '90).

Case 12. Fleming's tincture, 1 drachm. Recovery. Sulphate of zinc, tincture of digitalis, 20 minims hypodermically. Whisky, 1 ounce, by the mouth, followed by calomel, 8 grains. L. M. Whannel (Brit. Med. Jour., vol. ii, p. 791, '90).

Case 13. Fleming's tincture, 1 teaspoonful. Recovery. Mustard, spirit of ammonia comp. (B. P.), tincture of belladonna, brandy. T. F. H. Smith (Brit. Med. Jour., vol. i, p. 1109, '93).

Case 14. Fluid extract, 4 drachms. Recovery. Emetics, atropine and brandy subcutaneously. Henri E. R. Altenloh (N. Y. Med. Jour., vol. lxvii, p. 358, '93).

Case 15. Tincture, 7½ drachms. Recovery. Mustard, digitalis, and brandy subcutaneously; digitalis, nux vomica, and brandy by rectum; ether and ammonia by inhalation; brandy and ammonia carbonate by mouth later. G. H. Tuttle (Boston Med. and Surg. Jour., vol. xxv, p. 678, '91).

Case 16. Mentioned by, but not seen by, Dr. Tuttle. Tincture, 5½ drachms. Death. G. H. Tuttle (Boston Med. and Surg. Jour., vol. xxv, p. 678, '91).

Case 17. Preparation not noted. Four teaspoonfuls. Recovery. Sulphate of copper, digitalis, wine by mouth; whisky by rectum; whisky, $^1/_{25}$ grain strychnine, and digitaline, $^1/_{50}$ grain, hypodermically. M. A. Warriner (N. Y. Med. Record, vol. xxxix, p. 521, '91).

Case 18. Tincture, 2 drachms. Recovery. Apomorphine, stomach-tube, tincture of digitalis, 25 minims; aromatic spirit of ammonia, 45 minims; brandy, 2 drachms subcutaneously, heaters, sinapism to præcordia. S. Q. Robinson (Boston Med. and Surg. Jour., p. 192, '92).

Case 19. Tincture (B. P.), 30 minims. Recovery. Salt and water one and a half hours after poison. Sulphate of zinc two hours after poison. Charcoal, brandy, and water by mouth. William Hardman (Brit. Med. Jour., p. 1320, '93).

Case 20. Preparation not stated. Five drops. Recovery. Belladonna and strophanthus, champagne, brandy, heaters. J. D. Leigh (Edinburgh Med. Jour., vol. xl, p. 638, '95).

Reported by R. W. Greenleaf (Boston Med. and Surg. Jour., July 15, '97). [The tincture of aconite referred to is that of the old U. S. P.—Ed.]

Therapeutics.—Aconite is mainly used as an arterial sedative. By diminishing the force and the rapidity of the heart's action, it lessens blood-pressure, and, in doing this, tends to allay spasm and relieve undue excitability of the nerve-centres. It is, therefore, indicated while the pulse is high and resisting.

Aconite causing increased perspiration, it is indicated where, with a high pulse, there is dryness of the skin. The evaporation of sweat from the surface and the heat-radiation due to the increased peripheral circulation resulting from relaxation of the cutaneous capillaries also cause a reduction of temperature. Aconite also possesses diuretic properties. Hence it appears to be endowed with all the qualities requisite in the incipient stage of uncomplicated inflammatory disorders, as an anodyne sedative.

In children aconite may be given whenever the spasmodic element is clearly marked: in fever preceding attacks of quinsy, pharyngitis, etc.; in asthma and the asthmatic crises of bronchial adenopathy; in pertussis and other spasmodic coughs; in laryngismus stridulus; in palpitations associated or not with hypertrophy of the heart; and in convulsions. (Comby.)

> The physiological action of aconite and veratrum viride is so similar that what is to be said of aconite can be applied with equal force to veratrum. The physiological action of aconite may be stated thus: Primary action: stimulation of the peripheral nerve-endings; stimulation of the vasomotor mechanism; powerful stimulation of the respiratory center. Secondary action: paralysis of the overstimulated peripheral nerve-endings; pronounced depression of the heart; lowering of the blood-pressure; reduction of temperature. The indications for the use of these drugs are, then: to relieve pain, reduce temperature, promote diaphoresis, slow the heart, and reduce blood-pressure. To relieve pain aconite is dangerous and inferior to other remedies. As a diaphoretic it does not compare with Dover's powder or pilocarpine. It is inferior to digitalis for slowing the heart. Bloodletting is to be preferred to it for lowering the arterial tension, and finally the reduction of fever by means of drugs is not a thing to be very greatly desired. W. B. Hill (Jour. Amer. Med. Assoc., Dec. 12, 1903).

By reason of its sedative and depress-

ant action aconite is contra-indicated in all cases in which prostration exists or threatens. If the respiration is embarrassed, if the heart is in asystole, if the patient is depressed, recourse must be had to tonics and stimulants. In broncho-pneumonia, pneumonia after the primary stage, valvular affections of the heart, and in all cases of collapse occurring in acute infectious diseases, aconite is particularly contra-indicated.

Fever. — The physiological effects enumerated afford sufficient ground for its value in the reduction of all the phenomena attending the febrile state: high temperature, dry skin, hard and frequent pulse, etc. The tincture is preferable here, as it is in all other disorders. The best effects are produced by means of small doses. One minim is first given, then another minim in one-half hour. After that, 1½ minims is given every half-hour until the febrile symptoms are reduced or until physiological symptoms of the drug appear. Aconite should always be greatly diluted.

Aconite is especially of value in the fever attending the incipient stage of catarrhal disorders. It may be used as an apyretic in continued fevers and infectious diseases,—variola, scarlatina, erysipelas, etc.,—but large doses are usually required, involving correspondingly great danger.

In the reflex fever which sometimes follows the use of the catheter it is very efficient. (Wood.)

Disorders of the Respiratory Tract.—In acute disorders of the nose, throat, and lungs the depressing effects exerted by aconite upon respiration through its influence upon the respiratory centre and upon the muscles concerned in respiration are added to the qualities previously enumerated. Hence its value in acute coryza, pharyngitis, tracheitis, bronchitis, pleurisy, and pneumonia. In all of these, 3 drops of the tincture every hour should be administered until the physiological effects—tingling and numbness of the lips and tongue — are experienced, when the remedy should be given less frequently. After the initial stage of the affections enumerated, aconite should be discontinued, especially in pneumonia, in which affection its administration is positively harmful as soon as the asthenic stage begins. In the chronic disorders of the respiratory passages—including phthisis —it is more hurtful than beneficial.

Rheumatism. — Aconite is considerably used in all forms of rheumatism as an anodyne. It is especially indicated when the skin is dry. The diaphoresis resulting from its use, added to its analgesic effect, tend to shorten the duration of the disease. This is especially the case in the acute rheumatic pains due to exposure.

Neuralgia.—In the form of neuralgia characterized by exacerbations during damp weather aconite is sometimes very effective in small doses frequently repeated. If the painful spot does not cover much surface, application of the tincture over it with a camel's-hair pencil contributes markedly to hasten the relief.

Meningitis, Pericarditis, and Peritonitis. — These three inflammatory disorders of serous membranes are mentioned concurrently owing to the fact that their early manifestations are equally influenced by aconite. In peritonitis especially its effect as an anodyne tends to prevent vomiting: an important feature. In pericarditis it markedly increases the chances of recovery by reducing the number of pulsations, thus prolonging the resting periods between beats.

CARDIAC DISORDERS. — By lowering arterial tension and diminishing the number of heart-beats it may be of advantage in functional disorders, but when organic lesions are present it had better not be used. It is sometimes employed in uncomplicated hypertrophy, however, to antagonize exaggerated action, but its effects should be closely watched lest incipient degeneration be present.

ACONITINE. — Aconitine is an alkaloid obtained from *Aconitum napellus*, and represents the active principle of aconite. It occurs in colorless, tabular crystals, slightly soluble in water, but soluble in alcohol, ether, and chloroform. It is extremely poisonous.

Dose. — The preparations entitled to confidence are those of Merck and of Duquesnel, the latter especially, owing to its constant strength. The German preparations of aconitine are thought to be impure. The dose is from $^1/_{300}$ to $^1/_{250}$ grain.

The virulence of aconitine causes the responsibility of the physician to be involved to a greater degree than in the case of other poisons. It should be administered in small doses only, if used at all.

> Case of fatal poisoning by a single dose of aconitine in France. Physician fined 100 francs. Editorial (Gaz. des Hôp., Paris, Sept. 8, '91).
>
> Nitrate of aconitine given by practitioners in doses of $^1/_{32}$, $^1/_{22}$, and $^1/_{16}$ grain. These relatively large quantities are apt to be followed by serious results. Editorial (Medical Age, May 25, '92).

The activity of aconitine is markedly increased when it is administered hypodermically.

> Injections of the alkaloid in various neuralgias excessively painful and productive of toxic symptoms. A. Cohn (Deutsche med.-Zeit., Oct. 22, '88).

The fact that the preparations dispensed vary greatly in strength according to the source of production militates against its use.

> Especial attention called to the various degrees of strength of the several varieties of aconitine on the market. The division into French, German, and English aconitine is as unreliable as it is unscientific. William Murrell (Medical Bulletin, June, '90).

Physiological Action. — Aconitine in minute doses reduces the action of the heart and thereby reduces arterial tension. In large doses, or in persons presenting undue sensitiveness to the effects of aconite, this action manifests itself more markedly, reaching, in fatal cases, to arrest of the heart in diastole. Aconitine reduces temperature by this influence on cardiac action; it also tends to inhibit respiratory action by its paralyzing influence upon the muscles of respiration. On general principles, aconitine tends to reduce functional action through its paralyzing influence upon nerve-centres.

Aconitine Poisoning.—The symptoms following a poisonous dose are those of aconite poisoning, but they occur more rapidly; hypodermically administered, aconitine may cause death in less than a minute. Tingling in the mouth and throat, numbness of the face and extremities, reduction of the cardiac pulsations, shallow breathing, dilatation of the pupils, cold sweats, purging, etc., follow in quick succession, death coming on through paralysis of the heart.

> Case of poisoning in which a stout German took eighteen tablets of aconitine each containing $^1/_{200}$ grain, probably within half an hour's time. One hour and a half afterward there appeared

symptoms of paraplegia; stertorous, irregular respirations, from six to thirteen times a minute; strangling; and tingling in the fauces. Pulse irregular, pupils slightly dilated and sluggish. Recovery under morphine hypodermically, emetics, whisky, and ammonia. Valentine (N. Y. Med. Jour., Dec. 15, '88).

Treatment of Aconitine Poisoning.— The general indication is to prevent syncope. The recumbent position, warmth, and stimulants are pre-eminent among the measures to be employed. The stomach-tube may be used if the heart's action is not too weak, while the stimulation is procured by hypodermic injections of ether, ammonia, or whisky. Strychnine, digitalis, or caffeine are also valuable, but their action is not as rapid. They may be utilized to great advantage to sustain the heart's action, however, after the patient has shown evidences of reaction.

Case in which $^1/_8$ grain of crystallized aconitine was taken in mistake; the patient saved through energetic measures, combined with large doses of caffeine, subcutaneously, to sustain the heart. Veil (La France Méd., Sept. 29, '93).

Therapeutics.—Aconitine is possessed of no advantage that the preparations of aconite usually employed do not offer, and is much more likely to give rise to untoward results. It has been used with advantage in neuralgia and pneumonia, especially in the broncho-pneumonia following upon influenza. Erysipelas seems also to have been successfully treated with aconitine.

Treatment of erysipelas of the face by the use of nitrate of aconitine eminently successful in doses of $^1/_{640}$ grain every two hours, taking care not to exceed a daily dose of $^1/_{64}$ grain. Course greatly lessened and great relief from pain. Tison and Bourbon (London Med. Recorder, Jan., '91).

Spurious Preparations.—Aconitine has also been obtained from other varieties of aconite,—*Aconitum ferox* and *Aconitum japonicum*,—but the properties of the preparations are still insufficiently known.

Aconitine obtained from *Aconitum napellus* possesses the same diaphoretic properties as pilocarpine. This effect is not obtained by the doses ordinarily employed. Aconitine from *Aconitum ferox* and *A. japonicum* has no such property. P. Aubert (Pharm. Centralhalle für Deutschland, No. 22, '94).

Pseudaconitine, a highly poisonous constituent of the aconite found in Nepaul, probably *Aconitum ferox*. Small, colorless, transparent, dextrorotatory crystals, very slightly soluble in water, readily in alcohol, chloroform, and acetone. Persistent tingling sensation on the tongue; slightly more toxic than aconitine. W. R. Dunstan and Francis H. Carr (Journal of the Chemical Society, p. 350, '97).

ACROMEGALY. — (Greek.) From ἄκρον, extremity, and μέγας, great.

Definition. — A non-congenital hypertrophy of the bones, especially the superior, inferior, and cephalic extremities. It was first described by Dr. Pierre Marie, of Paris, in 1885.

Symptoms. — In this disease there are two classes of symptoms:—

I. Constant or almost constant.

(*a*) Hypertrophy of the hands. This is often the first symptom noticed. They are spade-like,—namely, thick and wide, without notable increase in length. The bones, muscles, cellulo-adipose tissue, and skin are all involved in the overgrowth. The skin is not œdematous, but is firm on pressure and somewhat darkened. The fingers are much enlarged, sausage-like, as thick at the distal as at the proximal extremities. The interphalangeal furrows and the lines of the palms are exaggerated, while the thenar and hypothenar eminences are enlarged. The finger-nails seem short, widened, and are

usually striated longitudinally. The fingers are rarely club-shaped.

The hypertrophy does not seem to affect the wrist to the same degree as it

Typical hand in advanced acromegaly. (*Gastou and G. Brouardel.*)

does the remainder of the forearm and hand. The arm and forearm, therefore, though they may be slightly enlarged, do not appear so. There is no interference with the function of the hands.

Sciagraph of the above hand, showing hyperostosis.

(*b*) Hypertrophy of the feet. This is of the same character as that of the hands. They are widened, thickened, but not lengthened, and the hypertrophy ceases or appears to cease at the ankles.

(*c*) Hypertrophy of the head. The skull is slightly increased in size, but the face is much more affected: it is lengthened; the eyes seem small compared to the size of the eyelids and orbital borders; the nose is enormous and flattened; the cheek-bones and chin project and the lips are much thickened. The lower jaw-bone is especially affected. The tongue is increased in size and may even

Case showing typical hypertrophy of the feet. (*Gifford.*)

protrude from the mouth and greatly interfere with speech. The hard and soft palate, the uvula, the tonsils, the pillars, and even the teeth may be enlarged, causing cough and difficulty in speaking and eating.

Case with marked hypertrophy of the scalp. Hutchinson (Archives of Surg., Oct., '89).

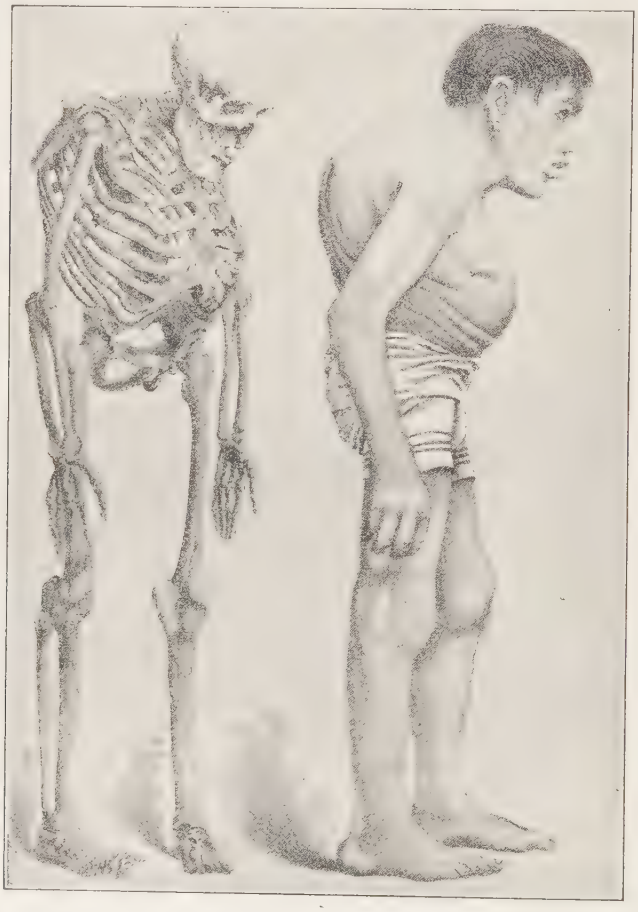
Case in which trophic lesion was analogous to acromegaly; chief symptom was gradual, progressive enlargement of head and neck. Denomination of "me-

galocephaly" proposed. M. Allen Starr (Amer. Jour. Med. Sci., Dec., '94).

(*d*) Thorax. The vertebræ are especially affected, causing cervico-dorsal kyphosis, which may coincide with lumbar lordosis. The hypertrophy of the sternum, clavicles, ribs, costal cartilages, and scapulæ causes the chest to seem

Cheyne-Stokes variety, and inability to retain either food or drink in his stomach. Enlarged pituitary body found at the post-mortem. The gland weighed 475 grains, instead of 5 to 10 in the normal condition. J. R. Rathmell (Southern Practitioner, Dec., '95).

(*e*) Headache is often one of the first symptoms. It may be continuous or



Case showing characteristic alterations of the thorax. *(Fritsch, Klebs, and Brigidi.)*

flattened from side to side and increased in depth from behind forward. The deformity of the chest may make respiration difficult and cause it to become abdominal in type.

Uncommon symptoms: long-continued abnormal rhythm in respiration of the

paroxysmal, diffuse, or, as is more frequent, localized in the occiput or nape of the neck.

Two cases, one of which had suffered temporarily from exceedingly acute cephalalgia. Kalindero (Rev. Inter. de Méd. et de Chir., Oct. 25, '94).

(*f*) Amenorrhœa resulting in sterility is one of the first symptoms in women.

In two women premature cessation of menses and hypertrophy of pituitary body. Ransom (Brit. Med. Jour., June 8, '95).

Case appearing at 47 years; amenorrhœa was only transitory, and menstruation was normal. Thomas (Revue Méd. de la Suisse Rom., June 20, '93).

II. Secondary symptoms:—

The neck is often short and thick. The thyroid gland may be normal, atrophied, or increased in size. The larynx is usually enlarged, causing in women a low voice and dyspnœa. The nasal cavities may also be compromised by enlargement of the turbinated bones, another source of dyspnœa being thus afforded.

Case of acromegaly complaining of pain in the left side of the nose and slight difficulty in breathing. The inferior turbinated bodies were enormously enlarged; the other structures in the nasal cavity appeared normal. The anterior and posterior pillars, the soft palate, and the uvula were much thickened; also the tonsils and their capsules. The lingual glands were much hypertrophied. An external examination showed that the larynx was very much enlarged. The epiglottis was thickened. The arytenoid cartilages and the ventricular bands were enlarged. The glottis was very small. While the patient remained quiet, respiration was only slightly impaired, but excitement produced labored breathing and a crowing sound during both expiration and inspiration. During one of these attacks of dyspnœa the patient died. W. F. Chappel (Amer. Medico-Surg. Bull., Jan. 18, '96).

Case in which, besides other typical symptoms, the cartilages of the nose and ears were greatly thickened, and probably those of the larynx, as his voice had altered of late to a deep bass. The skin of the face was slightly pigmented; the orifices of sweat-glands enlarged. The tongue was enlarged enormously, the tonsils and uvula also. Difficulty in swallowing at times and slight asthmatic seizures. John N. d'Esterre (Brit. Med. Jour., Dec. 4, '97).

In women the mammæ are atrophied, the abdomen is enlarged and pendulous, and the pelvis and external genitalia enlarged and thickened. The uterus may be atrophied.

In man the penis, scrotum, and testicles may be enlarged or diminished. Sexual power and feeling may be abolished.

Case of acromegaly of fourteen years' standing in which, although the patient is 52 years old, there is no impediment of the sexual function. J. R. Rathmell (Southern Practitioner, Dec., '95).

The muscular system is usually atrophied, though it may be normal or hypertrophied. Electrical excitability is diminished (Erb) or increased (Verstraeten).

Case with amyotrophy, which appeared to be due to compression of the rachidian nerves. Duchesneau (Thèse de Lyon).

Some articulations (knee, wrist) have been found enlarged and giving creaking sounds on movement, owing to relaxation of the ligaments.

Case in which there were, with great deformity of wrists, trophic lesions of the joints,—a certain amount of muscular atrophy similar to that occurring in the progressive atrophy of Duchenne. There were also a few symptoms of Raynaud's disease and a trace of albumin in the urine. Middleton (Glasgow Med. Jour., June, '94).

Case in which there was a cystic tumor in the popliteal space, communicating with the joint; in the latter were, besides synovial fluid, five small, solid masses. Roswell Park (Inter. Med. Mag., July, '95).

The knee-jerk is not increased; it may be normal, decreased, or absent. Cardiac hypertrophy with palpitation sometimes occurs. Arterial sclerosis and

varicose veins have been noted. Hypertrophy of the lymphatic vessels and glands is not very infrequent.

Hunger and thirst are usually increased. Sometimes there is dyspepsia. Duchesneau records enteroptosis and nephroptosis.

Polyuria, glycosuria, peptonuria, and phosphaturia have been noted. Occasionally there is excessive sweating.

Case of acromegaly with Graves's disease and glycosuria. Lancereaux (La Sem. Méd., Feb. 16, '95).

Case of acromegaly in which there were, besides sarcoma of the hypophysis cerebri, diabetes and struma. Hansermann (Berliner klin. Woch., May 17, '97).

Case of acromegaly in a man 37 years of age in which there was also alimentary glycosuria, peculiar joint swellings, and paroxysmal hæmoglobinuria. The joint swellings were probably of trophic and vasomotor origin. The paroxysmal hæmoglobinuria was probably dependent upon alterations in the vessels, almost constantly found in acromegaly, and a causative rôle in the production of this disease. It is probable that the hypophysis secretes a substance that influences the heart and vasomotor system. Chvostek (Wiener klin. Woch., Nov. 12, '99).

Frequent observance of the coincidence of sugar in the urine in cases of acromegaly. Three cases: one of genuine diabetes mellitus, one of polyuria in which the sugar gradually disappeared after great variations in its percentage, and one of alimentary glycosuria. The last case attributed to a tumor of the hypophysis. W. Schlesinger (Wiener klin. Rund., Apr. 15, 1900).

Analgesia and anæsthesia of the skin have been reported and abdominal pain and great sensitiveness to cold. The skin is yellowish-brown and darkest at the extremities. It is dry and wrinkled. Warts are frequent. The hair is thick and abundant. The body-hair is thick and stiff.

Taste, smell, and hearing may be affected; but, above all, vision. There may be amblyopia due to papillary congestion, irregular contraction of the field of vision, and Argyll Robertson's pupil. Especially interesting is temporal hemiopia caused by pressure from the enlarged pituitary body.

Case in which there was rotatory nystagmus, bitemporal hemianopsia, and atrophy of the optic nerves. Reinhold Bolty (Deutsche med. Woch., July 7, '92).

Case beginning in the twenty-fifth year. Five years later there was atrophy of both disks with complete blindness in one eye and diminished vision in the other. The thyroid could not be felt. Dreschfeld (Brit. Med. Jour., Jan. 6, '94).

Thickening of eyelids, prominence of orbital ridges, exophthalmia, periorbital pains, hypersecretion of tears, nystagmus, etc., have been observed. Hertel (La Presse Méd., July 13, '05).

The following eye-symptoms have been noted by Maisonneuve: Exophthalmos; long, thick, bronzed upper eyelids; pupils reacting slowly to light, normally with accommodation. The movements of the eyes are slow, and, in raising them, there is a want of synchronism with movements of the lids. There is retinal engorgement.

Case in which the visual fields at no time showed any tendency toward the hemianopsic type which has so often been noted. This defect of vision is, in all probability, due, in most cases, to pressure exerted by the hypertrophied hypophysis cerebri. The claim that this pressure, as almost universally stated, is exerted upon the posterior border of the optic chiasm is certainly incorrect.

In spite of the gloomy prospect for good vision, which the case at one time presented after more than a year the sight was $^{20}/_{30}$ with each eye, and it continues to be good. Current accounts would lead one to expect progressive, optic nerve-atrophy, ending in blindness, in all cases where serious disturbance of

the sight has set in. H. Gifford (Western Med. Review, June 15, '97).

There is general muscular weakness, and the patients are melancholy and irritable. The intelligence remains unchanged in the majority of cases.

Case of married woman, 68 years old, who first manifested signs of mental defect at age of 50 and was taken to hospital for insane because of homicidal tendencies. Meanwhile the extremities became much enlarged, fingers sausage-shaped, features thickened, bones of chest thickened and enlarged, thyroid small, and thymus not discernible. Henry Waldo Coe (Jour. Amer. Med. Assoc., Dec. 3, '98).

Diagnosis.—Myxœdema.—In this disease there is simple œdematous infiltration of the soft parts, and a round, swelled face instead of the irregular face observed in acromegaly.

Case in which a feature of especial importance was the marked increase in the bulk of the overlying tissues, which presented the appearance and sensation of hard œdema exactly resembling myxœdema. The treatment has been solely by thyroid extract, the result being an immediate and marked amelioration of the disease. C. L. Greene (Med. Record, June 8, 1901).

Osteitis Deformans.—In osteitis deformans the face is triangular with the base upward; in acromegaly it is ovoid or egg-shaped, with the large end downward; in myxœdema it is round and full-moon shaped. (P. Marie, Osler.)

Leontiasis Ossea. — In this disease there is hyperostosis of the bones of the face and skull. The hyperostoses of the bones of these regions form boss-like masses; the hands and feet are normal.

Elephantiasis. — The elephantiasic thickening is limited to the skin and is unilateral.

Chronic Rheumatism. — In rheumatism there are characteristic deformities of the hands and feet, articular pains, muscular atrophy, and early impotence.

Rachitism and Lymphatism United. —Special deformities, absence of enlargement of lower jaw, and macroglossia.

Erythromelalgia. — Here the soft parts of the hands and feet are red, the face is unaffected, and there is no involvement of the bones.

Gigantism. — In true gigantism the body grows symmetrically. In acromegaly the abnormal development is promiscuously localized. Gigantism and acromegaly may, however, be present in the same case.

Acromegaly may be regarded as a partial giant-growth, but it differs very essentially from the latter. In gigantism the length of the body is over six times the length of the foot; in acromegaly it is under six times the length of the foot. Virchow (Berliner klin. Woch., Feb. 4, '89).

Case of an Indian, exhibited as a giant, who had, in addition to symptoms of acromegaly, facial hemihypertrophy. At the autopsy the pituitary gland was found to be much hypertrophied.

Case of another professional giant seven feet and five inches tall, who had only some symptoms of the disease. Acromegaly is sometimes associated with giant-growth. Dana (N. Y. Med. Jour., Aug. 12, '93).

Case in a man, six feet and seven inches in height. Another case cited, height seven feet and four inches, in which there was hemihypertrophy of the face, on the left side. This is a rare combination, being only the eleventh known. Dana (Jour. of Nervous and Mental Dis., Nov., '93).

Case of acromegaly in a giantess. Byrom Bramwell (Edinburgh Med. Jour., Jan., '94).

Autopsy on a giant from Egypt, showing exostoses and diffuse porous osteoperiostitis. Sirena (La Méd. Mod., July 18, '94).

Autopsy on a German giant who had not begun to grow abnormally before

the age of 36 years. Fritsch and Klebs (Corres. f. Schweizer Aerzte, p. 662, '93).

[In both cases there was acquired gigantism, which is the most common form. It would seem that gigantism, as well as dwarfism, arises from a disease occasioning disturbances of growth, and that, owing to the osseous lesions frequently present, there is a certain analogy with acromegaly. Unilateral hypertrophy of the face is of rare occurrence. P. SOLLIER, Assoc. Ed., Annual, '95.]

PULMONARY OSTEOARTHROPATHY. — In this disease there is hypertrophy with deformities, but of the osseous system only; no amenorrhœa nor enlargement of lower jaw. The third phalanx of the fingers is much enlarged, like a drumstick, the nails are lengthened, widened, striated longitudinally, curved over the finger-tip. The carpus and metacarpus are almost normal, while the wrist is enlarged and deformed. The same lesions occur at the feet, and the lower portion of the leg may be larger around than the calf. The long bones, especially of the leg and forearm, are enlarged. The joints are swelled and move with difficulty. Kyphosis exists, when present, only in the lower dorsal or lumbar region. The face is normal, except that the upper jaw-bone may be enlarged. Some chronic thoracic lesion is present. (Marie.)

Case presenting certain features like those occurring in hypertrophic pneumic osteoarthropathy. Lavielle (Jour. de Méd. de Bordeaux, Jan. 7, '94).

Pulmonary osteoarthropathy may give rise to some little difficulty in diagnosis, principally owing to its rarity. It is most likely to be confounded with acromegaly, but in the latter disease there is no alteration of the nails nor are the finger-ends nor the carpus and metacarpus much thickened. The chief characteristics of the disease are great enlargement of the hands, wrists, feet, and ankles, associated with, and secondary to, some chronic pulmonary affection, such as phthisis, chronic bronchitis, and empyema. In the joints the changes are effusion with enlargements and ulceration of the cartilages and articular ends of the bones. Marie is of the opinion that these changes are due to toxic poisoning, but Thorburn looks on them as tuberculous. The evidence either way is slight and indefinite. G. A. Bannatyne (Lancet, Feb. 23, 1901).

It is doubtful where acromegaly can be separated from pulmonary osteoarthropathy. (Arnold.)

PSEUDOACROMEGALIC SYRINGOMYELIA. —Affects usually the lower limbs only,— one only sometimes, and may not affect all the fingers. Deformities and trophic changes are present. Scoliosis and dissociation of sensibility are notable features.

Case of hereditary syphilis presenting great length of diaphysis of long bones, wrist, and elbow. Nobl (Le Bull. Méd., Aug., '95).

Etiology.—The disease usually begins between the ages of 20 and 40 years. It is more common in women than in men, and no influence can apparently be attributed to race, heredity, or antecedents.

Case in a woman aged 63 years. Ganse (Deutsche med. Woch., Oct. 6, '92).

Case in a young negro aged 10 years. Beavan Rake (Brit. Med. Jour., Mar. 11, '93).

Cases of acromegaly in father and son. In the latter a tumor of the pituitary body was found at the autopsy, together with generalized endarteritis and sclerotic atrophy of the thyroid gland. Bonardi (Revue des Sci. Méd. en France et à l'Etranger, Jan. 16, '94).

Case following excessive weakness due to parturition. Middleton (Glasgow Med. Jour., Aug., '95).

Case suggesting influence of traumatism upon development of acromegaly and diabetes. Marinesco (Le Bull. Méd., June 26, '95).

Pathology.—The skull may show disappearance of sutures, hypertrophy of

the external occipital protuberance, deformity of the condyles, thickening of the frontal and occipital bones, and increase in size of the processes inside the skull and, above all, of the pituitary fossa. Both maxillaries are enlarged, the lower especially so; the alveolar processes and zygomatic arch are also increased in size.

Sciagraph from a case of Dr. Sanger Brown's. The skin outlines are entirely lost; pointed chin shows striking prognathous type. The light area above the upper teeth is the antrum, distinctly bordered by an upper, bony plate. The outlines of the orbit are not shown. In normal cases the orbital arch shows itself almost as this region appears when a skull is viewed laterally. The frontal eminences protrude strongly. The light, semilunar area is not the frontal sinus, which often shows in sciagraphs, but is probably due to a more membranous bony formation than the outside layers. O. L. Schmidt (Medicine, July, '97).

In the vertebral column the hypertrophy especially affects the extremities of the cervico-dorsal spinous processes. The hypertrophy especially affects the bones of the extremities and the extremities of the bones (Marie).

There is dilatation of the air-sinuses of the skull, and changes in the temporo-maxillary articulation, permitting forward dislocation of the lower jaw. There is a tendency to formation of new bone, both in normal and abnormal situations. Thompson (Jour. of Anat. and Phys., July, '90).

The most characteristic lesion is a symmetrical thickening, which increases toward the projections. Arnold (Beiträge z. path. Anat. u. z. Allge. Path., B. 10, No. 1).

Histologically the growth consists in an hypertrophy of the medullary bone, while the periosteal bone is reduced to a thin layer. This attacks red marrow-bones especially. Duchesneau (Thèse de Lyon, '91).

Case of a young man who entered the hospital for a tumor of the right thigh, requiring amputation of the limb. The tumor was a malignant osteoid growth of J. Müller or chondrosarcoma of Virchow. The patient had recovered from the operation, which had been performed in December, 1894, when thoracic disturbances and symptoms of acromegaly developed progressively. Death occurred toward the end of September, 1895. The lungs and pleuræ contained enormous enchondromatous tumors, as large as a child's head in some cases; microscopically they were found to be everywhere composed of cartilage-tissue at every period of development.

Sciagraph of skull in acromegaly. (*Schmidt.*)

The pathological lesions of acromegaly existed in the limbs; the hyperplasia of the periosteum, instead of being limited to the extremities of the phalanges, extended the entire length of the limbs to the hips. The shafts of the femur and humerus were surrounded throughout their entire length by osteophytes; on the ulna and radius some of the osteophytes could still be compressed by the finger. The epiphyses were normal, but were, from the youth of the patient, not yet connected to the shaft. The condition of the pituitary body was not given in the autopsy. In its neighborhood, at the spheno-occipital synchondrosis, a myxomatous enchondrosis was found. R.

Virchow (Berliner klin. Woch., Dec. 16, '95).

Hyperplasia of the connective tissue and adipose tissue of the periosteum is present, while its inner layer gives rise to osseous neoformation.

There is central absorption due to osteoblasts, with intense peripheral histogenesis, in the periosteum and articular cartilage. (Marie and Marinesco.)

The lesion most frequently observed, and apparently the main feature of the disease, is one of the pituitary body. This organ may undergo various pathological changes, ranging from hypertrophy to the more malignant forms of neoplasm, such as sarcoma.

Of 19 published cases there was hypertrophy of hypophysis in 3, hypertrophy with increase of connective tissue in 1, sarcoma in 3, adenoma in 2, softened adenoma in 1, tumor with little cavities lined with epithelium in 1, glioma in 1, tumor with character not specified in 3, vascular hypertrophy in 1, colloid degeneration in 1, sclerosis and atrophy in 1, and necrosis with softening in 1. Sternberg (Zeit. f. klin. Med., vol. xxvii, p. 86, '95).

Enough cases have been reported to refute the hypothesis that the enlargement of the hypophysis cerebri in acromegaly is, like the other hypertrophies, merely a symptom of the disease. If simple hypertrophy were the constant lesion, it might be claimed that it was a result and not a cause of the disease, but it hardly needs argument to show the improbability that any one disease would cause, in a single organ, so many and various morbid conditions as are enumerated in Sternberg's list. W. L. Worcester (Boston Med. and Surg. Jour., Apr. 23, '96).

Analysis of thirty-four recorded necropsies on cases of acromegaly. Changes in the pituitary gland found in all. In all but three there had been either hypertrophy or tumor. Percy Furnivall (Lancet, Nov. 6, '97).

Of 97 reported cases of acromegaly, autopsy had in 15 cases: 12 showed changes in the hypophysis cerebri. There is a connection between the changes in the pituitary body and acromegaly. Personal view that all organs have a double function: a negative, withdrawing something from the organism; and a positive, introducing something into the organism. The progressive development of one organ has progressive development of other organs as a consequence. Hansermann (Berliner klin. Woch., May 17, '97).

Case of acromegaly in which death occurred in an accident. At necropsy the skull was found uniformly thickened and heavy, and all the air-spaces were dilated. The sella Turcica was deep and wide, and the pituitary body was converted into a cyst containing semifluid substance. Percy Furnivall (Lancet, Nov. 6, '97).

(1) Cases of acromegaly associated with true tumor of the hypophysis are certainly not so numerous as has been heretofore supposed; (2) there is not as much constancy in the pathological condition of the hypophysis as there is in the enlargement of the heart, the thyroid gland, or the sella Turcica; (3) acromegaly does not depend, at least not solely, upon abolition of any function of the hypophysis; (4) a relationship between the thyroid gland and the hypophysis has already been amply proved; (5) it is not at all improbable that proliferation of the histological elements of the hypophysis may be instituted in some cases by primary enlargement of the sella Turcica; in other cases an œdema or hæmorrhage ex vacuo; (6) we have no reason for supposing that enlargement of the sella Turcica must be as constant an occurrence in acromegaly as the changes in other bones, or that it might not take place from the same cause or causes. Mitchell and Lecount (N. Y. Med. Jour., Apr. 29, '99).

Necropsy of a case in a man who died at the age of 70 and which had the typical characters of the malady. The pituitary body was three times its usual size; the thymus was looked for in vain; and the thyroid body was goitrous fibrocystic, the two lobes—but especially the right—being much enlarged. The heart was large, without valvular lesions; so was

the great sympathetic; but the diameter of the large blood-vessels was not sensibly increased. Microscopically the pituitary body showed in places small colloid masses, a very marked dilatation of the vessels, and hypertrophy of the cells. Pagniez (Bull. et Mém. Soc. Anat. de Paris, S. 6, vol. i, p. 942, 1900).

The pituitary gland as a factor in acromegaly and giantism: (1) the pituitary body is still functional; (2) disturbances of its metabolism are the principal factors in both acromegaly and giantism, the difference between the results being simply due to the stage of individual development at which the disturbance of the function begins; (3) the nature of the overgrowth in both these diseases is primarily on the order of a pure functional hypertrophy, later, however, losing some of the definiteness of its impulse and either producing immature tissue of a mixed type or resulting in simple hæmorrhagic exudation, with either cyst-formation or complete breaking down of the tissue-mass; (4) it seems probable, although upon this head the evidence is still uncertain, that some part is played by this body in "dwarfism," rickets, and the dwarf forms of cretinism; (5) a reflex disturbance of its function may possibly underlie the dystrophy accompanying pharyngeal adenoids; (6) it would appear to be a sort of "growth-centre," or proportion-regulator of the entire appendicular skeleton. Woods Hutchinson (N. Y. Med. Jour., July 28, 1900).

The pituitary body is sometimes enlarged from the size of a pigeon's egg to that of a hen's egg; it dilates the pituitary fossa and clinoid processes, and is lodged in a considerable depression in the base of the brain.

Case in a woman, 35 years old, in whom symptoms of confirmed acromegaly had been present for three years. In May, 1893, there were visual disturbances, and double optic neuritis was found to be present. In July, 1895, there were noted: complete blindness of the right eye, continuous headache, and pain in the limbs; the patient became somnolent and died in a comatose condition.

Autopsy showed the thymus to be abnormally voluminous and the thyroid gland normal. Some signs of adhesive meningitis were present at the vertex. The pituitary body was enlarged, softened, and vascular. The dura mater of the sella Turcica had disappeared, and the bone had been worn away in that region. The hypertrophy of the pituitary body had compressed the two optic tracts and the chiasm, the right optic tract being partly destroyed and the left optic tract completely so. No other lesion was found. The pituitary body showed, microscopically, the appearance of a gliosarcoma. Roxburgh and A. Collis (Brit. Med. Jour., July 11, '89).

Case of acromegaly with post-mortem, at which the thymus was found replaced by a mass of fibrous fat and lymphoid tissue. The thyroid was enlarged symmetrically and filled with small cysts. The gland-substance was normal under the microscope, but there was increase in the interstitial tissue. Pituitary body was enlarged and a portion of it presented consistence and microscopical appearance of an adenoid tumor. Pearce Bailey (Phila. Med. Jour., Apr. 30, '98).

Cases have been reported, however, in which, although typical symptoms of the disease were present, no disease of the pituitary body could be detected.

Case with numerous cystic cavities in the brain, but with a normal pituitary body. Waldo (Brit. Med. Jour., Mar. 22, '90).

Case in a man, aged 74 years, in whom there was no tumor of the hypophysis, but endarteritis with atrophy and sclerosis of the thyroid body. Bonardi (Riforma Medica, Aug. 24, '93).

Again, hypertrophy of the pituitary gland may not give rise to the manifestations of the disease.

Case in which hypertrophy of the pituitary gland had caused no phenomenon of acromegaly. Packard (Amer. Jour. Med. Sciences, June, '92).

The pressure of the growths of the pituitary body on the optic tracts gives

rise to the ocular disturbances enumerated.

Case in which the pituitary body, which was the size of a walnut, was very soft and vascular. The mass had so pressed upon both optic tracts and the chiasm as to cause total disappearance of the left tract and partial destruction of the right. On the left side of the mass there was a blood-clot the size of a large pea. Roxburgh and Collis (Brit. Med. Jour., July 11, '96).

The hypophysis cerebri generally lies wholly or partly in front of, not behind, the chiasm, and its anterior part is so much nearer the optic nerves than its posterior part is to the chiasm (on account of the nerves, chiasm, and tracts slanting upward posteriorly) that with a uniform enlargement of the gland the nerves in front of the chiasm would almost always be pressed upon sooner than the chiasm itself. Zander (Deutsche med. Woch., vol. iii, p. 13, '97).

The nervous symptoms sometimes observed may also find in the pressure upon the surrounding cerebral tissues one of their causes.

Case of acromegaly of many years' standing in a man, aged 54, who, in the last three years, had developed Jacksonian epilepsy limited to the right upper extremity and right side of the face. Hypertrophy of the pituitary gland constitutes a cerebral tumor capable of exciting from a distance the cortical psychomotor centres. Raymond and Souques (Centralb. f. Nerv., No. 82, '96).

The viscera may take part in the hypertrophic process. The liver frequently shows fatty degeneration.

Case of acromegaly in which the heart was enormously enlarged, weighing two pounds and nine ounces: one of the largest hearts on record. O. T. Osborne (Med. News, May 22, '97).

Case of a man, 23 years of age, who was quite well until 1893, when he had an attack of typhoid fever, after which typical acromegaly developed, including pigmentation, except that there was no great enlargement of the lower jaw. He died, soon after admission, of diabetic coma. Necropsy showed, in addition to the usual external signs of acromegaly, a general enlargement of the viscera. Liver weighed 90 ounces, the spleen 9 ¾ ounces, the heart 13, and the kidney 9. The pituitary body was so enlarged as to distend the sella Turcica, and contained several drops of a fluid resembling pus. It did not appear to have compressed the commissure, and there was no optic atrophy. Norman Dalton (Lancet, May 22, '97).

The pigmentation noticed in the above case might have been due to the condition of the thyroid, the association of acromegaly with exophthalmic goitre being a recognized one; the disease had obscure relations with myxœdema, and had been successfully treated by means of thyroid extract, although the work of Schäfer and Oliver had shown that extracts of thyroid and of pituitary body were antagonistic in action. H. D. Rolleston (Brit. Med. Jour., May 22, '97).

The skin of the extremities shows hyperplasia of the papillæ, and hypertrophy of the derma, all the connective-tissue system being enlarged, that of sweat-glands, sebaceous glands, hair-follicles, external and internal vascular walls, and, above all, the lamellated sheath of the infradermic nerves are likewise degenerated.

There is marked sclerosis of the great sympathetic system, especially the lower cervical ganglion. The neuroglia in the brain is hyperplastic.

Autopsy showing following conditions: The lymphatic ganglia of the neck profoundly altered, containing no more lymph-follicles; all varieties of white globules present, with single nucleus, with polymorphous nucleus, and with multiple nuclei. The striated muscular tissue of the neck showed atrophy and sclerosis, the nuclei had budded abundantly, and the sarcoplasma had undergone vacuolar and granular fatty degeneration. The hypertrophied pituitary gland was undergoing process of necrosis, and liquefaction of its constituent parts had taken place; the portions escaping

this destruction consisted of lymphoid tissue similar to that of the lymphoid ganglia of the neck. The thyroid gland was affected both by atrophy and glandular hypertrophy, as well as by hypertrophy of the connective tissue and lymphoid infiltration.

The liver showed fatty degeneration and glandular atrophy, with slight lymphoid infiltration of the interlobular connective tissue. There was chronic interstitial and parenchymatous inflammation of the kidneys, hyperplasia of the splenic pulp and of the Malpighian follicles. The tongue was increased in size from hyperplasia of its connective tissue. Claus and Van der Stricht (Annales de la Soc. de Méd. de Gand, No. 71, '93).

The blood does not show evidence of great alteration.

In one case the amount of hæmoglobin was 95 per cent. of the normal; the average of ninety-six countings showed 7,000,000 red corpuscles to the cubic millimetre. The proportion of white to red corpuscles was about 1 to 400. Church and Hessert (Med. Record, May 6, '93).

The kidneys show chronic parenchymatous nephritis in the cortical substance, moderate sclerosis of interstitial tissue, and peripheral infarcts.

In the thyroid gland the follicles are either found hyperplastic or cystic, and contain hæmoglobin crystals. This organ is generally hypertrophied. The thymus is occasionally found to have persisted.

Case showing a large glioma of the hypophysis, and each lobe of the thyroid enlarged and containing a cyst. Bury (Med. Chron., July, '91).

Typical case, which appeared to date from an old cerebral affection, in which hypertrophy of the thyroid gland was also observed. Bruzzi (Gaz. degli Osp., Aug. 4, '92).

Case of diabetic acromegaly, with thick and heavy skull, and an occipito-frontal diameter of sixty-six centimetres. The pituitary body was softened and voluminous; the thymus had persisted, and the thyroid body was cretaceous. Lathuray (Lyon Méd., July 11, '93).

Case with hypertrophy of the pituitary body and persistence of the thymus; the thyroid gland was enlarged and weighed nearly two ounces. T. Coke Squance (Brit. Med. Jour., Nov. 4, '93).

The thyroid gland was examined in 24 cases; it was normal in only 5 and hypertrophied in more than half. The thymus was examined in 17 cases; it was absent in 7, hypertrophied in 3, and persistent in 7. The sympathetic ganglia were examined in 10 cases and reported as hypertrophied in 6. The only constant associated changes appeared to be those in the pituitary body; these changes were not uniform and might occur without acromegaly. Percy Furnivall (Lancet, Nov. 6, '97).

The spleen and the lymphatic glands are generally sclerosed.

Among the various theories as to pathogenesis of acromegaly the following are the most prominent:—

Acromegaly is due to an unusual development of the vascular system; it is a thymic angiomatosis. The endothelial elements originating in the thymus play the part of vasoformator cells, causing an increase in the vessels, and hypernutrition and increase in growth of the extremities where the blood-current is the slowest. (Klebs.)

Case in which there was hypertrophy of the pituitary body compressing the optic nerves, persistence of the thymus, and hypertrophy of the great sympathetic. Cepeda (Revista Balear de Ciencias Medicas, Jan. 15, '92).

Case in which the tumor of the pituitary body was a typical spindle-celled neurosarcoma.

The thymus was of considerable size, but without any change in its elements; the thyroid gland was enlarged and filled with small cysts containing colloid matter. Mossé and Daunic (Soc. Anat., Paris, p. 633, Oct. 25, '95).

It is due to disturbances in the evolu-

tion of the genital life. (Freund, Verstraeten.)

A trophoneurotic affection, due to changes in the central and peripheral nervous system, causing hypertrophy of the extremities by means of the vasomotor system. (Recklinghausen and Holschewnikow.)

A systematic dystrophy, something like myxœdema, and connected with some organ (pituitary body?) much as myxœdema is in connection with removal or alteration of the thyroid gland. (P. Marie.)

The pituitary body has been destroyed in animals without causing acromegaly. (Marinesco, Vassale, Sacchi.)

The cases described by Hagner, Fraentzel, and Gombault-Marie must be considered as a form standing between acromegaly and osteoarthropathy. The disease begins in youth, without being preceded by any affection of the lungs; the bones of the face and the cartilages are affected, and the pathological changes are more like those of acromegaly than of osteoarthropathy. F. R. Walters (Progrès Méd., No. 3, '96).

Three cases of acromegaly, in the first of which diabetes, gigantism, and splanchnomegaly were present; in the second arteriosclerosis, and in the third dyspepsia and a lesion of the pituitary body (sarcoma, cysts); but other quite different changes were likewise visible, namely: degeneration of the thyroid gland, periependymatous gliomatosis, and cancer of the viscera.

When the embryological and anatomical relations of the ependyma and pituitary body are considered, it may be asked whether they do not, as a whole, form an anatomical and physiological system governing the processes of nutrition and capable, when diseased, of giving rise to the dystrophic changes of acromegaly. Dallemagne (Arch. de Méd. Exp., No. 7, '96).

Prognosis.—Progressive, slow, and interrupted advance of the disease, lasting from twenty to thirty years, and ending in death either by cachexia, by some complication, or, very rarely, by sudden syncope represent, in brief, the course of the vast majority of cases.

Treatment.—At present it can be only symptomatic. The extracts of thyroid gland and pituitary body will probably prove useless as curative agents. Pain and insomnia are relieved by antipyrine, sulphonal, etc. Arsenic has proved useful in some cases. Iron in large doses and hydrotherapy have done some good in one case in the hands of Brissaud, and ergot in those of Schwartz.

Case of acromegaly treated with desiccated thyroid gland with good results. Solomon Solis-Cohen (Med. and Surg. Reporter, May 26, '94).

Case treated by extract of pituitary; no appreciable result. Analogy between myxœdema and acromegaly suggesting the thyroid gland; rapid improvement. Caton (Brit. Med. Jour., Feb., '95).

Three cases of true acromegaly treated with tabloids of the pituitary body of sheep. In the first case the headache, which was, at times, exceedingly violent, diminished, and recurrence of the headache coincided always with momentary cessation of the treatment; in the second case the headache, pains in the limbs, and parœsthesia of the hands diminished, and the tumefaction of the soft tissues was less. In the third case, a diabetic patient, no results were obtained. Marinesco (Soc. Méd. des Hôp., Nov. 8, '95).

De Cyon mentions a case of a child, 12 years of age, who suffered from acromegaly. Under influence of treatment by hypophysin continued during six or seven weeks the condition of the patient was much ameliorated; weight fell from 121 1/2 to 101 1/4 pounds, and circumference of abdomen from 44 1/2 to 31 inches. Headaches had diminished in intensity and in duration, pulse had become regular, and intelligence began to awaken. Lancereaux (La Sem. Méd., Nov. 23, '98).

Case of acromegaly in a woman aged 42 years corresponding in all respects to

the usual type of the disease. The employment of thyroid tabloids produced a persistent and decided improvement. Gibson (Edinburgh Med. Jour., Dec., '99).

Our knowledge of the fact that the pituitary body is usually enlarged in cases of acromegaly is sufficient evidence that the gland is diseased and that administration of the dried pituitary body is indicated as much as thyroid extract in cases of myxœdema. The pituitary body may be found enlarged in other diseases than acromegaly, and this may be compared with goitre where it exists without Graves's disease. The observations were upon three cases. In the first there was little or no general improvement, but when the drug was stopped the patient always requested that it be continued. In the second there was marked improvement which lasted over a year and a half; during this time the patient only suffered from headache once, and that was when the medicine was withdrawn for a day and a half. The third case was complicated by advanced renal disease and died suddenly from heart-failure, although he was considerably benefited by drug. The administration of pituitary body had little effect upon the first case, but the last two seemed to be considerably benefited in their subjective symptoms. Kuh (Jour. Amer. Med. Assoc., Feb. 1, 1902).

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ACTINOMYCOSIS.—Gr., *ἀκτίς*, a ray; *μύκης*, fungus.

Definition. — A parasitic, infectious, and inoculable disease due to the development of the actinomyces, or ray-fungus. First described in 1877 in cattle by Böllinger and in man by James Israel; it can no longer be considered a rare disease. From its frequent development in the lungs it has often been confused with tuberculosis.

Symptoms. — The symptoms vary according to the locality of the disease. The affection is chronic and exceptionally rapid. The granulation tissue is abundant and the mass resembles a tumor. Previous to suppuration it is quite firm, and, if progressing rapidly, is surrounded by diffuse œdema. Pain and tenderness hardly ever exist. When suppuration occurs the mass increases rapidly in size.

Total of 500 cases from literature showing that the various regions of the body are proportionately the site of the disease, as follows: Head and neck, 55 per cent.; thorax and lungs, 20 per cent.; abdomen, 20 per cent.; other parts, 5 per cent. In France the face and neck were affected in 85 per cent. of the 66 cases reported. Poncet and Bérard (Le Bull. Méd., Aug. 8, '97).

Mammary actinomycosis may occur in two ways: primary and secondary. In the former infection occurs either from propagation of the actinomycotic grains in the milk-ducts or from their penetration into the tissues through a continuity of the skin. Four cases of the primary form witnessed. The secondary form spreads to the mammæ from the lung (most frequently) or some other organ. The disease is not easy of diagnosis, and is liable to be confused with tubercle, cancer, interstitial inflammation, or syphilitic disease; and repeated microscopical examination of discharges or pieces of tissue should be made. The prognosis in the primary form is good, but in the secondary form unfavorable. Mileff (Gaz. d. Höp., Jan. 1, 1901).

1. CUTANEOUS SURFACE.—Usually, a lesion of the skin is secondary to the evolution of an underlying actinomycotic tumor, which, by its growth, bursts through the skin. A sanguineous or purulent liquid, containing the characteristic grains, issues from the ulcerations so formed. The grains are small, opaque, yellowish-white, or yellowish masses about as large as a pin-head, which are composed of smaller grains,

measuring about one-tenth of a millimetre. These smaller grains are formed by a central mass, of interwoven or straight fibres, whence extend toward the periphery spoke-like prolongations, with club-like terminations. Rarely the affection may develop primarily on the fingers, hand, nose, or face. It forms a small, round, ligneous mass, which may soften in a few weeks, burst through the skin, and give a granulous and varied pus, containing actinomycotic granulations. The border of the granulation is uneven, violet-hued, and undermined. Around the original mass there arise secondary masses; so that the entire lesion forms a violet-red, indurated patch, deeply adherent, and somewhat resembling scrofuloderma.

In cutaneous actinomycosis the lymphatic ganglia are usually not enlarged. Pain is, in some cases, intense; in other cases it is awakened only by pressure.

Pathognomonic spots, which are more or less deep in color according as the general color of the lesion is more or less pronounced. If the general color is pale, the spots are bluish-red or violet; if the tint of the mass is deeper, the spots present a blackish or slate color. These spots vary in size from that of a pea to that of a pin's head. They appear to correspond to the points at which the wall of the abscess is thinnest, and it is here alone that fistulæ form. Derville (Jour. des Sci. Méd. de Lille, Aug. 31, '95).

Case of actinomycosis extensively involving the skin in a boy, aged 13, whose family lived over a stable-yard, and who suffered from an apparently simple attack of serous pleurisy, from which he recovered with marked retraction of the affected side. Shortly afterward he was readmitted to a surgical ward on account of abscesses over the front of the chest and right hip, which were regarded as tuberlous, and scraped. He returned to the hospital seven months later with a very extensive tract of disease implicating the skin, chiefly on the back, the most important feature being large sarcomatous-looking growths, ulcerating at various points, situated upon hard, brawny, and deeply-undermined skin. From the ulcerative points pus excluded, mixed with characteristic yellow granules, readily recognized, microscopically, as actinomycosis. Treatment by iodide of potassium and thyroid tabloids appeared to be attended with benefit. (*See colored plate.*) J. J. Pringle (Trans. of the Royal Medico-Chir. Soc., '95).

2. Alimentary Canal.—*Teeth.*—The fungus has been found in carious teeth (Israel), often side by side with leptothrix (Senn), or almost pure culture with no manifestation of disease except chronic periodontitis (Partsch).

Tongue.—In man three cases of this affection have been found on the tongue, one of which was of primary development; the other two are believed to have found origin in a carious tooth.

Case of actinomycosis of the pharynx in a girl aged 15 years. The tonsils showed white projections resembling masses of moss, which seemed to grow in the crypts. The pharyngeal wall also showed these white masses. The diagnosis was established microscopically. G. Didsbury (Revue de Laryn., d'Otol., et de Rhin., Oct. 15, '95).

Lingual actinomycosis in cattle appears as a nodular tumor, with prolongations into the parenchyma, of ligneous hardness.

Jaws. — The lower jaw is the most frequently affected. At first the disease resembles periosteal sarcoma, until the loose tissues of the neck are reached, when it often rapidly extends downward along the subcutaneous connective tissues and intermuscular septa. (Senn.)

Early symptom: Every patient who without any ascertainable reason is unable to open the mouth is attacked by actinomycosis (Poncet). Patient who had great difficulty in opening the mouth, yet in whom the most minute ex-

Case of Actinomycosis extensively involving the Skin. (Pringle)

amination revealed no cause. Five or six months later an abscess formed; pus containing the characteristic yellow grains appeared. Besnier (Lyon Méd.; Revue Méd., Aug. 30, '99).

Eight cases tending to show that a proportion of the cases ranking as alveolar abscesses may be due to the specific organism of actinomycosis. Few cases enter hospital with advanced actinomycosis of the jaw, and many recover after simple incision and after rupture. Certain cases of generalized disease in the lungs, intestinal tract, liver, etc., occur in which the organism gained entrance through the food, or was swallowed, and therefore the surgeon should aim at making external drainage. C. A. Porter (Boston Med. and Surg. Jour., Sept. 13, 1900).

The upper jaw is rarely primarily affected. It then tends to attack rapidly the adjacent parts, and even the base of the skull and brain.

Actinomycosis may attack any part of the body, but it is most frequently located in the cervico-facial region, especially the angle of the inferior maxilla. In this location it may present itself in two forms: acute, the symptoms being those of a septic phlegmon; subacute, in which there is early and continuous trismus, softening, and œdema. Poncet (Archives Prov. de Chir., Mar. 1, '96).

Case of intermittent otorrhœa suddenly attacked with fever and intense pain behind the right eye, then right-sided trifacial neuralgia, and shortly a palsy of the abducens. The antrum was trephined and the carious ossicles removed. The jaws showed no disease. There was some temporary improvement, followed by recurring trouble in the left ear, with a drawing over of the head like a torticollis. In an indurated swelling on the neck actinomycoses were found in pure culture. Potassium iodide was given. The swelling rapidly disappeared, leaving fistulas behind. Then followed cachexia, diarrhœa, somnolence, and death. The autopsy disclosed an actinomycotic involvement of the base of the brain, and in the neck an actinomycotic meningitis. Quervain (Deut. Zeit. f. Chir., Apr., '99).

Autopsy indicating that actinomycosis of the middle ear may arise from blood-infection from a primary focus elsewhere in the body, or from a neighboring actinomycotic process in the mouth, pharynx, tonsil, or from carious teeth; that the fungus may enter the middle ear through the Eustachian tube or through the external auditory canal. J. C. Beek (Prager med. Woch., Mar. 29, 1900).

In three cases the predominant sign was a sharply-defined local movable mass, which is always strongly indicative of the disease. Hofmeister (Beit. z. klin. Chir., B. 26, H. 2, 1900).

In the case of a butcher the first signs were in the floor of the mouth in the form of a pseudoranula; afterward swelling of the cheek showed characteristic yellowish discharge and granules. Lenoir and Claisse (Jour. des Praticiens, July 14, 1900).

3. Intestinal Canal. — The disease begins with a sharp lancinating pain in the abdomen and follows the course of chronic peritonitis. Swellings forming abscesses are found on the anterior abdominal wall which sometimes communicate with the intestine. It may also start from the vermiform appendix. There have also been cases of primary actinomycosis of the colon with metastatic deposits in the liver.

Case in a man, 21 years of age, who passed through a febrile disease of several weeks. Shortly afterward a swelling formed below the crest of the ilium, which disappeared spontaneously, but eventually returned. The whole iliac fossa showed a hard, dense infiltration. Free incision proved the disease at once to be actinomycosis. At the bottom of the very large wound lay the perforated appendix. Later on the ascending colon became involved. Ascending colon resected and the appendix extirpated. F. Lange (Annals of Surg., Sept., '96).

Case of abscess of abdominal walls in which the cavity contained actinomycosis and two fish-bones. The whole mass was excised, taking out the umbilicus and portions of the rectus muscle down

to the peritoneum, where an intestinal adhesion was met with. Though hernia necessarily resulted, no serious results ensued, and the patient is now quite well. The actinomycosis was probably a secondary infection, not present in the fish-bones when eaten, the parasite being swallowed later, and having entered the abscess from the intestine.

Case of actinomycosis of the neck removed under the impression that it was a tuberculous abscess. Mixter (Boston Med. and Surg. Jour., July 6, '99).

Analysis of 13 cases of ano-rectal actinomycosis obtained from literature. The average age was 31 years. Eight were men, and 9 of the patients lived in the country. The ascending form of infection is rarely secondary, being most frequently the result of direct contact with materials infected with the ray-fungus, such as straw, hay, etc. In one of the cases the inoculation was made in a perineal scar in a woman who slept upon straw. In two others inoculation arose from a spike of wheat that the patient had passed through the urethra. Descending actinomycosis is the most common ano-rectal form. It is due to the infection of the wall of the rectum by fæcal matters that contain the micro-organism from a previously diseased point in the colon. Delacroix (Gaz. Heb. de Méd. et de Chir., July, '99).

4. Genito-Urinary Tract.—The uterus may also become invaded by the disease, the first manifestation being the discharge of a turbid fœtid fluid containing the characteristic shreds and masses.

Case of actinomycosis of the uterus in a woman 64 years of age. For four years she had noticed a discharge from the vulva, usually consisting of blood, but sometimes yellowish and fœtid. The uterus was prolapsed. General health good. The uterus found slightly enlarged, with gaping os. A drop of the fœtid yellow liquid was found at the os. Under the microscope these shreds showed the characteristic appearances of actinomycosis. Vaginal hysterectomy. Recovery. Davide Giordano (La Clinica Chir., June, '95).

5. Bronchial Tubes and Lungs.—In bronchitic actinomycosis the affection is less severe in winter than in summer, which is the contrary of what is observed in ordinary bronchitis. It can be classified in three groups: (1) lesions of chronic bronchitis, (2) miliary actinomycosis, and (3) cases with broncho-pneumonia and abscesses. The lower lobe is attacked more frequently than the upper; the opposite is the case in tuberculosis.

Review of 14 recorded cases of actinomycosis of the lung. The only 2 which recovered were those in which radical operations, with resection of four or five ribs, and cauterization of the diseased cavity in the lung were carried out. All those that were simply incised and drained ended fatally. The infection of the lung may be secondary to either cervico-facial or pharyngeo-œsophageal actinomycosis, or it may be primary, either through the bronchi or from an external wound. There are three forms clinically: (1) the pulmonary, with insidious onset, going on to induration of a large area of lung, generally in the subclavicular or postero-lateral regions, the apices being usually free; (2) the bronchial, with a diffuse bronchial catarrh, and fœtid muco-purulent expectoration, containing the fungus; (3) the pleural, with effusion; the co-existence of pleural effusion with retraction of some part of the thoracic parietes—due to fibrous changes in the lung—is pathognomonic. Another pathognomonic symptom is the presence of a swelling in the wall of the thorax where it has been invaded by the fungus, along with shrinking of the lung causing retraction of the thoracic walls; later on this softens and becomes subfluctuating without the formation of large abscesses. Puncture obtains a fluid containing fragments of fungus. Death may occur after months or years, according to the varying invasion of other organs by the disease; in one case of rapid diffusion of the fungus death occurred in twenty-four days. Parascandolo (Brit. Med. Jour., from Clinica Mod., Nov. 7, 1900).

6. Brain. — Here, tumor-like symptoms exist during life, with headache, paralysis of the abducens, congestion of the optic papilla, and attacks of unconsciousness.

Necropsy indicating the probable mode of infection of the orbit and brain. Sinus found leading from the orbit to the gum of the upper jaw; the ray-fungus had probably lodged in or near a tooth, as it has so often been found to do. The fungus was probably carried into the system on an ear of corn chewed at harvest-time. Having reached the orbit, it crept along its outer wall and in the wall of the right cavernous sinus to the base of the brain, ultimately setting up meningitis and small abscesses, and burrowing through the pituitary body and sella Turcica to the cavernous sinus of the left side. In all probability the disease had reached the cranial cavity before admission into the hospital. W. B. Ramson (Brit. Med. Jour., June 27, '96).

Cerebral complications and death in a case of cervico-facial actinomycosis in a man aged 61. At first localized in the region of the left inferior maxilla, where it was mistaken for periostitis from dental caries, it invaded later the upper part of the neck and the temporal region. Here it caused a subperiosteal abscess, which, spreading to the spheno-maxillary fossa and the back of the orbit, finally infected the meninges through the sphenoidal fissure. A secondary infection by a slender bacillus produced an abscess in the left temporal lobe containing fœtid pus. This abscess burst into the lateral ventricle, which was considerably dilated, and produced coma and death about seven months and a half after the appearance of the first symptoms. Bourquin and de Quervain (Rev. Méd. de la Suisse Rom., Mar. 20, '97).

Diagnosis.—When the process is very rapid, actinomycosis may stimulate acute phlegmonous inflammation and osteomyelitis; or, when wide-spread, syphilis.

Sarcoma. — This form of neoplasm does not suppurate or break down so early.

In the jaws it is to be differentiated from dental affections: epulis.

Tuberculosis. — In this disease the lymphatic glands are infected, and the apices are usually the first involved.

Carcinoma. — The skin or mucous membrane involved is in close connection with the tumor; in actinomycosis the skin will be found broken on microscopical examination.

Syphilis.—A gumma will, in two or three weeks, be sensibly affected by large doses of potassium iodide, which does not act so rapidly in actinomycosis.

The undoubted influence exercised by iodide of potassium countenances the suspicion that many patients supposed to be syphilitic have really been actinomycotic. Poncet (Glasgow Med. Journal, Apr., '95).

Lupus. — The diagnosis depends, in this condition, upon microscopical examination.

Etiology.—Both men and animals are probably infected from vegetables or water (Israel), from eating ears of barley, or rye, when the fungus penetrates through the wound or abrasion thus provoked, or in many cases through carious teeth. Intestinal actinomycosis is due to taking contaminated food or water, when the fungus becomes implanted upon an already diseased tissue, multiplies, and causes active proliferation of the submucous tissue.

Case where the affection was transmitted by kissing, between bridegroom and bride. Baracz (Wiener med. Presse, Jan. 6, '89).

[Farmers should be warned against the habit, so common among them, of chewing bits of straw, wheat, oat-chaff, etc., the most prolific cause of the disease. E. Laplace.]

Actinomycosis is frequently met with in shoe-makers. This is due to their habit of placing their needles in their mouths. Ullmann (Le Bull. Méd., Nov. 17, '97).

Actinomycosis of the lower jaw ac-

quired by a tooth-brush maker in the following manner: Hogs' bristles were washed, then held in mouth before sticking into the handle-holes in bundles. Guinard (Bull. et Mém. de la Soc. de Chir. de Paris, T. 26, No. 6, 1900).

Total of 72 cases of actinomycosis from American sources collected. Six personal cases, 2 of which had not been previously reported. In one alveolar abscess followed chewing wheat-grains with a carious tooth. In a second case a quantity of pus collected in the right iliac fossa. The patient died of malnutrition, having recurred after evacuation. J. Rühran (Annals of Surg., Feb., 1900).

Pathology. — The actinomycoses were formerly thought to be mold-fungi (hyphomycetes), but Bostroem, in 1885, proved by cultivating them that they were a variety of cladothrix, belonging to the schizomycetes.

The mass is made up of granulation tissue, which, except for the presence of the ray-fungus, would be mistaken for a round-celled sarcoma. Epithelioid elements and giant cells are also seen. In the granular mass, or in the pus coming from a case of actinomycosis, the fungus itself appears under the form of small, yellow, brown, or even green masses, about a pin-head in size, which, on microscopical examination, are found to be composed of a central interwoven mass of threads, from which radiate club-shape-ended rays; in some specimens certain rays project far beyond the others. In man the clubbed bodies are frequently absent (Senn). The histological lesions are alike in the actinomycotic nodule and in the tuberculous follicle; only the foreign body differs. Water or a weak solution of sodium chloride causes the rays to swell enormously and lose their shape; ether and chloroform have no action upon them.

The yellow grains are not always to be found in fistulæ, etc., unless they are carefully sought in scrapings, etc. An early diagnosis is essential, since later the disease may be beyond the resources of therapy. A. Poncet and L. Bérard (Le Bull. Méd., Mar. 28, 1900).

Case in which microscopically there was no appearance of the ray-fungus in the fresh pus, and yet microscopical examination showed the presence of fungus at once. The absence of the typical grouping of the micro-organisms is not sufficient to exclude the diagnosis of actinomycosis, as the micro-organisms tend to arrange themselves in different ways at different times. W. Silberschmidt (Deutsche med. Woch., Nov. 21, 1901).

At a certain stage there are in every colony three elements,—viz.:—

1. Club-shaped formations.
2. A centrally-placed net-work of fungous filaments of varying shape and size.
3. Fine coccus-like bodies (spores), which originate from the fungous filaments, and grow into long rods and branching twigs.

Typical actinomycosis is the disease in which occur the characteristic mycelial masses, having club-shaped radiations. Atypical actinomycosis includes such diseases as Nocard's *farçin de bœuf*, and infections which clinically and anatomically resemble actinomycosis, and are caused by branching mycelial organisms which correspond quite closely to the cultural peculiarities of the streptothrix actinomyces, but fail to form the characteristic grains in the tissues and pus. Berestneff (Zeit. f. Hyg. u. Infekt., vol. xxix, p. 94, '98).

STAINING.—The following stains have been used:—

Wedl's orseille (Weigert).

Eosin (Marchand).

Cochineal—red (Dunker and Magnussen).

Hæmatoxylin alum (Moosbrugger).

Gram's method — section staining (Partsch).

Safranin in aniline oil, followed by K. I. (Babès).

Solution of orcein in acetic acid (Israel).

Picrocarmin—fungus, yellow; other parts, red (Baranski).

The actinomyces in a section are best shown by Gram's method, first with methyl-violet, then with Bismarck brown (Tillmann).

CULTIVATION.—It is difficult to cultivate in coagulated blood-serum (O. Israel), coagulated blood-serum and agar-agar (Boström), and coagulated egg-albumin and agar-agar (Wolff and J. Israel).

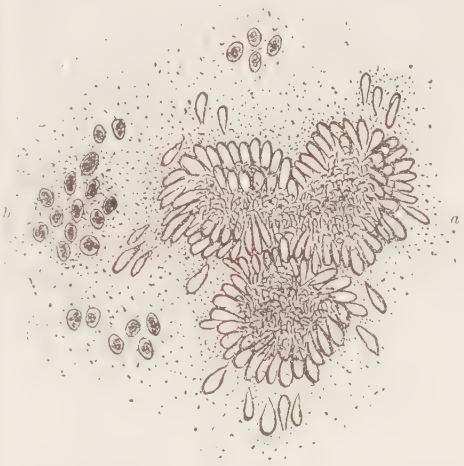
From 5 typical cases of human actinomycosis numerous inoculations were made upon various media, which were kept partly under aërobic, partly under anaërobic, conditions; growth of streptothrix actinomyces took place in only 20 of 64 primary cultures. After the first generation the organism did better when grown without oxygen; the actinomyces grew well when inoculated in eggs in the usual manner. The colonies consisted of longer and shorter threads, which stained by Gram's method, and always presented true branching, although sometimes the branches were hard to find; the cultures were rather short-lived; in one case the growths lived through 11 generations during 7 months; in two cases through 4 generations in 3 1/2 months, but in five cases death occurred after the first generation. In inoculation experiments on rabbits, guinea-pigs, and mice a fatal actinomycosis was not produced, although many features recalled the pictures of the disease. Francis Harbitz (Norsk Mag. f. Laegevidensk., vol. lix, p. 1, '98).

Inoculation.—It has been successfully carried out by James Israel and Ponfick, from tissue and from pure cultures.

In one inoculation experiment a characteristic deep-yellow tumor was found in the liver, proving a general infection. In all other inoculation experiments the author had found the tumor remaining limited to the peritoneal cavity and consequently improbable of causing general infection. Max Wolff (Deutsche med. Woch., Mar. 1, 8, '94).

Opinions differ as to its power of producing pus, a secondary infection by the pus-germs being thought the true cause of the pus sometimes found with actinomycosis. Dissemination by the lymphatic system never occurs. Glandular enlargement indicates secondary infection.

In pure infection with the actinomyces fungus the pus secreted is not always thin. This fungus alone, without the admixture of the ordinary pus-producing micro-organisms, can produce suppuration. The entrance of the common pus-producing micro-organisms into actinomycotic foci does not kill the fungus; but, on the contrary, may bring about such conditions as favor its development. Kozerski (Archiv f. Derm. u. Syphilis, B. 38, H. 2, '96).



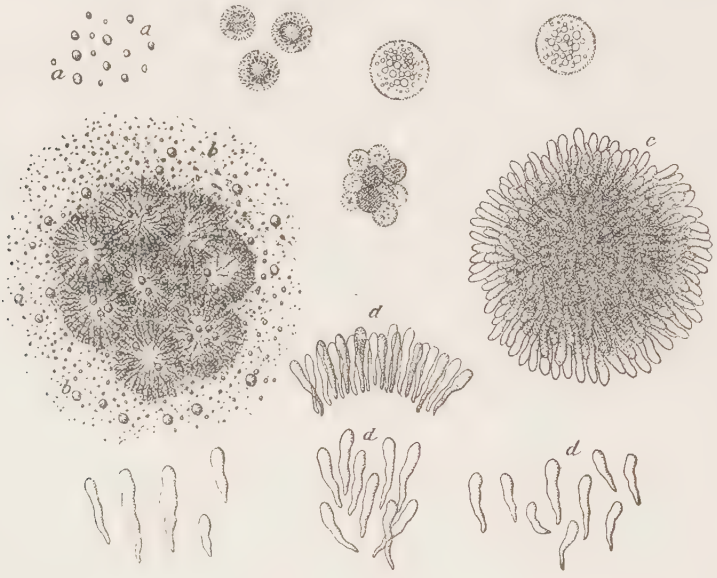
a, Ray-fungus or masses, showing central mycelium of actinomycosis. *b*, White blood-corpuscles, showing their relative size. (*Poncet and Bérard.*)

1. CUTANEOUS SURFACE. — Around the primary lesion are small secondary lesions. Two forms are described: (*a*) The anthracoid, which pursues a rapid course, with fever, and sometimes septicæmic in character. It is characterized

by flat tumefaction, with multitudes of small openings with yellow granulations, from which thick pus exudes. (*b*) The ulcero-fungous, which pursues a subacute course, with tendency to chronicity. In the face it tends to form burrowing abscesses instead of recognizable tumors.

2. Bronchial Tubes and Lungs.—Some observers believe that the peribronchial lymphatic vessels and glands disseminate the fungus or its spores in the lungs; when the fungus reaches the lung-tissue proper, granulation tissue is formed, which, through secondary infection, suppurates. Amyloid degeneration of other organs may occur, or metastasis of the disease, in case a pulmonary vein has been pierced. At times the pericardium or peritoneum becomes affected. (Strümpell.)

Case of actinomycosis of pleura and chest-wall in a child, aged 6, admitted into St. Bartholomew's, suffering from empyema of the left side. History of bronchitis and pain in the left side, but from this recovery had apparently taken place. Six ounces of curdy pus evacuated, revealing actinomycosis. The temperature remained high. Three swellings successively opened. As sinuses persisted, the patient was put in a bath of weak iodine and under iodide of potassium marked improvement, when death occurred under chloroform administered for the extraction of a tooth. Left lung found quite collapsed, but otherwise normal, and incased in a brawny material containing abscesses. Prolonged search needed to discover actinomycosis. F. S. Eve (Brit. Med. Jour., Apr. 10, '97).



Ray-fungus (*c*, *c*, *c*), club-shaped bodies (*d*, *d*, *d*), and spores (*a*, *a*, *a*) found in the pus of actinomycosis. (*Poncet and Bérard.*)

3. Alimentary Canal.—In the jaws the mass usually resembles a sarcoma, but, if incised before secondary infection and suppuration has occurred, the reddish surface will be seen to be intermingled with yellowish spots, which are collections of actinomyces.

In the intestines the fungus causes proliferation of the submucous tissue,

and whitish patches in the intestines. External fistulæ are commonly found.

Actinomycotic growths in the liver in man have a characteristic naked-eye appearance, from their peculiar honeycombed structure. The cases between the fibrous trabeculæ are full of caseous matter in which the more or less spheroidal masses of the fungus are imbedded. In museum specimens, which have been for some time preserved in spirit, the contents of the loculi may have fallen out, and the honey-combed appearance is then much more marked than in recent specimens. Crookshank (Lancet, Jan. 2, '97).

Condition of metabolism in patient subject of toxic influence of actinomycosis. Of abnormal elements in the urine, albumin and peptone (?) were found in traces, while urobilin was present in extremely slight amount. Acetone and sugar absent; nitrogen-excretion largely exceeded ingestion; reaction of urine was not distinctly changed; urea was slightly decreased. Alloxur bodies varied proportionally to variation in excretion of nitrogen. Uric acid bore no definite relation to amount of xanthin bases. Ammonia was not increased, while total sulphates bore direct relation to amount of nitrogen, but ethereal sulphates are not increased. Excretion of phosphates not changed, except slight decrease in amount of earthy phosphates and chlorides. R. Schmidt (Centralb. f. innere Med., Feb. 26, '98).

Prognosis. — The prognosis is serious in proportion to the rapidity with which suppuration occurs. Actinomycosis of the upper jaw is more serious than actinomycosis of the lower jaw, as it has a greater tendency to invade the deep structures. Internal actinomycosis is almost always fatal, owing to its inaccessibility. External actinomycosis may cause death from pyæmia, septicæmia, and exhaustion. When so placed as to be easily removed and treated early the prognosis is favorable. A permanent recovery usually follows a complete removal of the primary focus, as metastasis is rare. (Senn.)

Actinomycosis has a pronounced tendency to spontaneous recovery except in internal organs. (Schlange.)

From an analysis of sixty cases the following conclusions are reached: When the disease involves the head and neck, except in a few cases when the base of the skull is invaded, the course is favorable, recovery taking place in from three to nine months. It is exceptional for the fistula to persist or to form anew, after the lapse of a year. Pulmonary actinomycosis may terminate in recovery. The prognosis of actinomycosis is the more favorable as the anterior abdominal walls are involved and the posterior escape. Death usually results from amyloid degeneration and wasting. If actinomycosis present pyæmic manifestations, a fatal termination is to be expected, as a number of vital organs are likely to be involved. Actinomycosis may pursue a chronic course, continuing thirteen years or longer, if functionally important organs be not involved, as when the process confines itself to the connective tissue about the spinal column.

Treatment.

1. General. — Potassium iodide was found useful in animals by Thomassen and Nocard. In man it should be thoroughly tried before surgical intervention is resorted to, especially when the disease is so extensive as to prevent complete removal by surgery. The results obtained from iodide of potassium have been remarkable in some cases and negative in others. This divergence of views, according to Pernet, depends on the variation in the virulence of the disease, in its evolution in different individuals, in the difference existing in the receptivity of the tissues, and on the influence of secondary infective processes. In recent

and purely actinomycotic lesions the results may be excellent; in old-standing cases, and where the ray-fungus is associated with streptococci, staphylococci, and the bacterium coli commune, the drug treatment is less successful.

> In two-thirds of the cases of chronic actinomycosis of the face and neck the results of iodide treatment are *nil*. In three-fourths of the recent cases recovery has been obtained by it, combined with surgical treatment, and in one-fourth by iodide treatment alone. Potassium iodide cannot be regarded as specific in actinomycosis in man. If, at the end of some weeks, improvement is slight only, operative interference should be carried out at once. Bérard (France Méd., '97).
>
> Drugs most successful in pulmonary actinomycosis are potassium iodide and eucalyptus. If there is any involvement of chest-wall, surgical treatment should be undertaken. Sabrazès and Cabannes (Revue de Méd., Jan. 10, '99).
>
> Four cases, in one of which the tumor was situated below the angle of the scapula. All the patients were given iodide of potassium, and the wounds were treated with peroxide, tincture of iodine in full strength or solution, and packed in iodoform gauze until all evidence of presence of the fungus had disappeared. J. C. Munro (Boston Med. and Surg. Jour., Sept. 13, 1900).

The injection of a 5-per-cent. solution of permanganate of potassium into the cysts has been of advantage.

> Case in which a swelling over the twelfth rib near the spine caused severe pain. The hypodermic injection into the mass of 15 minims of a 5-per-cent. solution of permanganate of potash followed by marked relief. Iodide of potassium, 45 increased to 90 grains daily, had no control over the progress of the disease. H. B. McIntire (Boston Med. and Surg. Jour., Jan. 28, '97).

2. Surgical.—Local measures which do not completely remove the infected tissues do harm, as they frequently give rise to secondary infection, rapid extension, and death.

Cauterization with solid silver nitrate in actinomycosis of skin and soft parts in which suppuration and fistulous tracts have occurred possesses a specific action on the actinomycosis (Köttnitz).

> Case in which local applications and injections of nitrate of silver and nitrate of zinc, both into the sinuses and directly into the tissues, caused some argyriasis, but recovery. A. Mayer (Annals of Surg., Sept., '96).
>
> Case of pulmonary actinomycosis which at first had been mistaken for gangrene. For fœtid breath and expectorations, oil of eucalyptus was prescribed, in doses of 5 grains at first; later 10 grains in gelatin capsules, every four hours day and night. Three inhalations daily were ordered of the remedy. Under this treatment a cure was rapidly attained. G. Butler (Nouv. Rem., xlv, p. 288, '98).

3. Electrotechnical. — Two platinum needles, attached to the two poles of a constant-current battery, are to be inserted into the tumor. Through the two needles a current of 50 milliampères is to be passed, while every minute some drops of a 10-per-cent. iodide-of-potassium solution are to be injected into the mass. The solution is decomposed into nascent iodine and potassium. This is repeated every eight days, each session lasting twenty minutes, under an anæsthetic. (Gautier.)

Before suppuration all diseased tissues, glands, etc., should be removed and the parts, when possible, cauterized with the thermocautery.

After suppuration the parts should be treated as if they were tuberculous, curetting and packing with iodoform gauze (Senn).

> The disease was first noted in America in 1888. Up to the present time 100 cases have been observed in America. Of the 5 cases observed in the hospital,

the disease was primary in the cervico-facial region in 1, in the thoracic region in 1, and in the remaining 3 cases in the abdominal region. One of the abdominal cases died and 1 recovered. The sixth case, the disease being abdominal, terminated fatally. It is a curious fact that less than 20 of the 100 cases came from the Southern States, and only 2 of them were in negroes. Seventy-two of the whole number were men and only 23 women. The youngest case was a child of 6, the oldest a man of 70. In 36 of the cases the patients were more or less connected with farming and with the handling of grain. In most cases there was no definite history of infection, but in several the habit of biting straw and carrying it in the mouth had been indulged in. In 18 of the cervico-facial cases it was found that a carious tooth was the point of entrance of the parasite. The author emphasizes the point that no diagnosis should be made unless the ray-fungus is found. It appears that in 53 of the cases the malady affected the cervico-facial region, in 20 the thoracic region, and in 23 the abdomen. Only in 4 cases was the disease primary in the skin, but there is a tendency for the malady to spread, and for metastases to occur. Recovery occurred in 45 cases, and improvement in 14. In 32 death resulted, and in 9 no improvement was noticed. Surgical treatment is indicated, but repeated operations may be necessary. Simple incision and drainage do not cure the disease, which is almost certain to recur if the treatment be limited to such proceedings. Iodide of potassium seems to be of very doubtful efficacy. It has no action upon the ray-fungus, and, as it is said to act effectively *only* when used in conjunction with surgical operation, it follows that its influence is more than doubtful in most cases. W. G. Erving (Johns Hopkins Hosp. Bull., Nov., 1902).

Case of a farmer suffering from actinomycosis of the jaw. After the disease existed for upward of a year, a surgeon diagnosed it as cancer, and advised removal of the right half of the lower maxilla. Three months later this patient was exposed to the x-ray treatment for three months, twenty-five applications of the light being made in that time. The treatment was perfectly futile. After three months' rest the patient consulted a second x-ray specialist, who gave twenty applications in nine weeks with negative results. Iodine treatment, begun two years from the beginning of his trouble, was, however, followed by a marked improvement. Heidingsfeld (Cincinnati Lancet-Clinic, March 28, 1903).

Many actinomycotic tumors have been removed surgically under the impression that they were due to cancer, and a cure of the latter hailed in consequence of their non-recurrence. Mercury and the iodides will cure actinomycosis, which is thus often mistaken for syphilis to the moral detriment of the patient; the iodide treatment, however, is counseled in all doubtful cases. Poncet and Bérard (Lyon Méd., March 27, 1904).

ERNEST LAPLACE,
Philadelphia.

ACTOL. — Actol, or lactate of silver, is a bactericidal agent recommended by Credé and Bayer as a powerful disinfectant for wounds. It forms a soluble compound with the secretions, and this, being absorbed, influences beneficially not only the lesion treated, but also the neighboring tissues. It is non-poisonous: a point of great superiority over other equally active antiseptics.

Dose. — Subcutaneously, the drug is injected in $^1/_4$-grain doses, dissolved in 1 drachm of water. This may be repeated frequently. Locally, actol is used in the proportion of 1 to 4000; stronger solutions tend to color the skin of the hands.

Physiological Action. — Guinea-pigs were injected with 0.03 to 0.04 per cent. of their body-weight of lactate of silver, and received subsequently, after an interval varying from ten minutes to three hours, half a drop of a violent cholera culture. In every case the animals succumbed as rapidly as those used in con-

trolling the results. Similar experiments with other animals and virulent diseases have given the same results, showing that actol possesses no value as a general disinfectant.

A series of experiments performed by Marx, however, have shown actol to be a powerful local disinfectant. Two series of researches with anthrax bacilli showed that, in the first place, it protected the seat of injection completely against the swarms of micro-organisms in the blood and that it had an actual local bactericidal action in respect to these bacilli.

> In spite of its failure to produce an antitoxic serum, actol is one of the most powerful and at the same time most harmless bactericidal agents at present before the profession. Marx (Centralb. f. Bakteriol., Nos. 15 and 16, '97).

Therapeutics.—Actol may be injected under the skin in surgical affections. Credé has thus administered 15 grains in solution without witnessing the least untoward effect. Two grains to the ounce of water must not be surpassed in strength, however, lest the solution cause coagulation of the albumin of the subcutaneous tissue and arrest the dissemination of the remedy. In anthrax, furuncle, and erysipelas it is said to be effective when used in the above manner.

It may also be used in 1 to 4000 solutions as a mouth-wash, gargle, etc., in inflammatory and infectious disorders, owing to the favorable influence of silver salts upon mucous membranes in general.

ACUTE RHINITIS. See NASAL CAVITIES.

ACUTE YELLOW ATROPHY. See LIVER.

ADDISON'S DISEASE.

Definition. — A disease characterized by progressive asthenia, blood-impoverishment, frequent disorder of the gastric and intestinal functions, cardiac weakness, and irregular pigmentation of the surface in the form of bronze-colored spots, and, when not interfered with, uniformly tending toward a fatal result. It was first investigated and described as a distinct form of disease under the name of "Bronzed Skin Disease" by Dr. Thomas Addison, of London, in 1855. Since that time it has very generally been called "Addison's disease," and associated with disease of the suprarenal capsules.

Symptoms. — Perhaps the earliest symptoms to attract attention in this disease are those of asthenia, or lack of energy and endurance, with a variable condition of the digestive organs, and slight anæmic appearance of the surface. As the disease progresses the asthenia is manifested by shortness of breath, hurried and irregular action of the heart, and great sense of weariness from very moderate exercise. Sometimes there are present vertigo, tinnitus aurium, and syncope. The appetite is variable, but generally impaired, with occasional attacks of pain in the epigastrium and left side of the chest, increased by attempts to exercise. Moderate constipation exists in most cases, but is interrupted by increasingly frequent attacks of diarrhœa, and sometimes vomiting.

The foregoing symptoms are so much like those of pernicious anæmia that Addison's disease might not be suspected until the characteristic pigmentation becomes noticeable on some part of the surface. In most cases the pigmented, or dark-brown, spots appear first on the face and backs of the hands, varying much in size and in color. The latter is generally at first a light-brown or olive hue, but grows darker and the spots larger as the disease progresses. Spots

Bronzing of the Skin in Addison's Disease (Byron Bramwell)

Appearance of the tongue and nipple in Addison's Disease (Byrom Bramwell)

also appear around the nipple, in the axilla, on the genital organs, and wherever the surface is exposed to much friction from the clothing, and in some cases they spread until they occupy nearly the whole cutaneous surface, imparting to the patient much the same color as the mulatto or half-bred negro. (*See colored Plate I.*)

The palms of the hands and soles of the feet generally remain white. Brown or pigmented spots in many cases appear on the tongue and other parts of the mouth and in the vagina. Spots have been described on the serous membranes in a very few cases. (*See colored Plate II.*)

In a majority of cases the patients have complained of asthenia for a considerable time prior to the appearance of noticeable pigmentation on the surface. In a few instances the bronzed spots have been the first symptoms to attract attention. Cases in which bronzing does not accompany the other symptoms are not infrequent.

Case of subacute suprarenal cachexia without pigmentation. The patient had shown only two symptoms: (1) an uninterrupted rise of temperature during a month and a half, and (2) a progressive cachexia marked by loss of flesh and inability to undergo any muscular strain. Death followed about two months after the beginning of the affection. On post-mortem examination only the adrenals were found diseased; they showed a caseous suppurative degeneration of tubercular origin. The mucous membranes did not show the smallest sign of pigmentation. R. Marie (La Presse Médicale, July 24, '95).

Cases in which there existed pathological changes in the adrenals without the existence of pigmentary deposits in the skin or mucous membranes: Lejars (Bull. de la Soc. Anat., Mar.); Perry (Brit. Med. Jour., June 7); Pilliet (Bull. de la Soc. Anat., No. 26); Bradshaw (Liverpool Medico-Chirurgical Journal, July); Davidson (Liverpool Medico-Chi. Jour., Jan.); Blackburn (Jour. Amer. Med. Assoc., Mar. 31, '88). Cases of marked involvement of adrenals failing in the symptoms or bronzing: Virchow (Berliner klin. Woch., Apr. 29); Lamarque (Jour. de Méd. de Bourdeaux, May 5); West (Brit. Med. Jour., Nov. 9); Perry (Brit. Med. Jour., Oct. 21); Griffiths (Brit. Med. Jour., Feb. 2, '89). Girode (Bull. de la Soc. Anat., Apr.); Barth (London Medical Recorder, May 20); Counsell (Lancet, May 3); Vaughan (Brit. Med. Jour., Nov. 15); Cagliati (Riforma Medica, No. 6); Jacquemard (La Loire Médicale, Aug. 15); Ritchie (Edinburgh Med. Jour., July, '90), and others.

Case of Addison's disease without pigmentation. At the necropsy each suprarenal body was found to be enlarged and adherent to the surrounding parts, and thickly studded with tubercles of the size of peas, some of which had softened in their centres and contained pus. There was no apparent implication of the solar plexus. J. B. Bradbury (Lancet, Oct. 3, '96).

Addison's disease with phthisis pulmonalis and a typical pigmentation of the skin, consisting of melanoderma with symmetrical patches of leucoderma. C. O. Hawthorne (Glasgow Med. Jour., Oct., '96).

In addition to marked disturbance of the functions of the respiratory, cardiac, and splanchnic nerve, as indicated by shortness of breath, irregular action of the heart, and frequent gastric disturbances, a few cases have been recorded in which delirium, coma, or epileptoid convulsions occurred near the fatal termination. Von Jaksch has attributed these symptoms to acetonuria.

Case of Addison's disease in a man, aged 57, who suffered for months from violent attacks of delirium, convulsions, and eventually coma and death. The urine was always free from albumin. Later attacks were followed by coma, and, though treated with bleeding and injection of (artificial) serum, he died. The necropsy showed œdema of the cere-

bral meninges, pericellular and perivascular increase of leucocytes in the brain-cortex, globules of myelin in the white substance, and disseminated sparse nerve-degeneration in the posterior and lateral spinal-cord columns. A toxic agent resulting from the Addison's disease looked upon as the cause of the encephalopathy. Klippel (Soc. de Neurol. de Paris, Dec. 7, '99).

Case in a man of 46 in which peritonitis-like symptoms attended the final stage of addison's disease. The abdomen was flat and palpation was painful in the epigastrium, but it was tympanitic everywhere. He vomited frequently. The diagnosis had been in great doubt, but a malignant tumor along the gastro-intestinal tract was suspected. Post-mortem examination showed caseation of both suprarenal glands, with swelling of the lymph-glands and brown atrophy of the heart. No other changes of much importance were found. Some small, brownish spots were found on the left temple, on the under lip, and a few on the upper lip. There was no tuberculosis anywhere, excepting in the suprarenal gland. A diagnosis of Addison's disease is justified with this peculiar peritonitis-like symptom-complex if the conditions cannot otherwise be explained, even though all other symptoms of Addison's disease are absent. Zaudy (Zeit. f. klin. Med., B. 38, H. 4, 5, 6, 1900).

The temperature during the whole progress of the disease seldom rises above the natural, and in the advanced stage is often decidedly below. Roux mentions a case in which the temperature was only 32.5° C. (90.5° F.) four hours before death. Again, in the advanced stage of many cases the hands and feet are uncomfortably cold, and the asthenia so profound that the patient cannot maintain the erect position without vertigo, cardiac palpitation, or syncope.

The disease usually runs its course and terminates in death in from one to three years. A few cases are on record that terminated in six months, and, perhaps, a larger number that were protracted to eight and ten years. Those of longer duration have generally been characterized by repeated periods during which they remained stationary for several months at a time.

[One such well-marked case came under my own observation. The patient, aged about 35 years, had been exposed to much hard service and confined air on board of one of the naval monitors in active service during the war, between 1861 and 1864. Some symptoms of the disease were manifested as early as in 1865, but they made slow progress, and appeared to have several periods of remaining stationary, and did not terminate fatally until 1875: a period of ten years. During the last year he had been unable to walk more than a few steps without feelings of extreme exhaustion, and the final collapse resulted from protracted diarrhœa and vomiting. Large bronzed spots were on his forehead, temples, backs of his hands, and still more over the front part of his chest and abdomen. Like most cases of this disease, his emaciation was not extreme, though the hæmoglobin was notably diminished. N. S. Davis.]

Addison's disease may terminate in sudden death. Case in which the patient was supposed to be suffering from malarial cachexia and died in syncope. Autopsy revealed the true nature of the disease. Letulle (Bull. de la Soc. Anat., No. 6, '94).

Death two months after the onset of symptoms in a case in which one of the capsules presented an old tuberculosis, while in the other there were only recent granulations. Death hastened by intercurrent erysipelas. Mouisset (Lyon Méd., May 27, '94).

Diagnosis.—The presence of increased pigmentation of portions of the skin or mucous membranes, with progressive asthenia, frequent gastric disturbances, and cardiac weakness constitute the chief diagnostic features of melasma suprarenale, or Addison's disease. Increased pigmentation alone is not sufficient to justify a diagnosis of this affection.

Possibility of diagnosing Addison's disease when the characteristic discoloration of the skin and mucous membranes is absent: high-tension pulse or a very striking difference in tension between the peripheral pulse and that in the abdominal aorta. Neusser (Med. News, Sept. 18, '97).

Case of Addison's disease in a phthisical man in whom hot applications or mustard plasters caused pigmentation. These applications, kept up a week, caused marked pigmentation upon the abdominal wall, the right hip, the shoulders, and the calves. Slight pigmentation appeared spontaneously upon the patient's forehead before these experiments were tried. The same experiments produced pigmentation upon a patient with Pott's disease, in whom the autopsy showed tuberculosis of the suprarenal capsules. Jacquet and Tremolières (Bull. et Mém. de la Soc. Méd. des Hôpitaux de Paris, July 25, 1901).

Bronzed spots have been found in connection with a variety of malignant and other growths, especially in the abdomen and pelvis, with some cases of diabetes, exophthalmic goitre, and also in cases of pulmonary and peritoneal tuberculosis.

Case in which there was no tendency on the part of the discrete pigmented area to run together and become diffuse. The patches of pigmentation remained isolated throughout up to the time of death. These cases might be mistaken for various affections in which pigmentation occurs: idiopathic multiple sarcomata of Kaposi, xeroderma pigmentosum, pigmented lesions following syphilis, and lentigines. Trebitsch (Zeit. f. klin. Med., B. 32, S. 163, '97).

Pigmentation of mucous membranes generally considered diagnostic of Addison's disease seems to be found under other conditions. It appears to occur in some cases as mere accident without obvious cause; it may also be associated with chronic gastric diseases, such as carcinoma. Two cases of abdominal disease in which pigmentation was found on mucosa of mouth. In first case diagnosis lay between cirrhosis of liver and chronic peritonitis; in second there was cholangitis due to gall-stones, with tubercular disease of lung and testicles. In neither could Addison's disease be absolutely excluded, but group of symptoms by which it is distinguished did not occur. Nor can occurrence of this group be relied on as sure indication of disease of suprarenal bodies. Case noted in which weakness, anorexia, anæmia, vomiting, and diarrhœa were all present, but autopsy showed only chronic gastric catarrh without affection of suprarenals. In this case there was no pigmentation. Schultze (Deutsche med. Woch., No. 46, '98).

Addison's disease is not the only disease in which the condition of body presents discoloration of skin. A fair percentage of cases also runs its course without bronzing. Addison's disease must be diagnosed by exclusion of abdominal cancer, tubercle or lymphoma, tuberculosis of peritoneum, pernicious anæmia, and others, as sun-bronzing, vagabond's disease, melasma gravidarum, amyloid kidney, pulmonary tuberculosis, yellow fever and malarial fevers, hereditary bronzing, arsenic long continued, diabète bronzé of the French, pellagra in the chronic pigmentary form, Hodgkin's disease, chronic hepatic disease, and constipation in sedentary patients. A. J. Lartigau and W. H. Happel (Albany Med. Annals, Feb., '99).

On the other hand, a few cases have been recorded in which there was profound asthenia, severe gastric disturbances, irregular and weak pulse, and early death from syncope, when the autopsy revealed both suprarenal bodies much enlarged from caseous and tuberculous degeneration, but no pigmentation or bronzed spots on either skin or mucous surface. Letulle reported a case of this kind in 1894. The patient was supposed to be suffering from malarial cachexia, but died suddenly from syncope, and "the autopsy showed the two capsules to be transformed into fibrocaseous blocks as large as a mandarin orange." There is at present no known

reliable mode of completing the diagnosis of such cases during the life of the patient.

Direct relation between diseases of the adrenals and bronzing of the skin denied. Case where one suprarenal body was intact, the bronzing nevertheless appearing. Two cases in which extensive tuberculosis of both adrenals was present without a trace of dermal discoloration. Where there is discoloration there is extensive disease of the nerves and ganglia of the abdominal sympathetics. Lancereaux (Arch. Gén. de Méd., Jan., '90).

A similar view. Nothnagel (Med. Press and Circular, Jan. 12, 19, '90).

Discovery of a pigmented body, the size of the head of a large black pin, and presenting the complete histology of a suprarenal capsule in contact with the semilunar ganglion. Pilliet (Bull. de la Soc. Anat., No. 10, '91).

The true origin of the bronzing may still be said to be unknown, although several plausible theories have been advanced. In the cutis there are chromatophorous cells, which, as is the case in the frog and chamelion, are under direct nervous control, and they yield an excess of pigment of the Malpighian layer under certain conditions of nervous disorder. Raymond (Lancet, July 2, '92).

Examination of the skin in one case. Coloring composed of pigmented clasmatocytes, which, after penetrating by migration, fix themselves upon the supporting elements of the derma. Ch. Audry (Le Midi Médical, July 29, '94).

Masses of medullary cells and even buds of the substance of the suprarenal capsules in the interior of veins, more frequently in the medullary than in the cortical substance found in man. The same peculiarities were noted in the horse, ox, pig, and sheep. The medullary tubes, the central portion of which is filled with brown, hyaline masses secreted by the double row of cells seen on their interior, project into the lumen of the veins, at this point deprived of their endothelial covering. Conclusion that the brown, hyaline masses are secreted by the suprarenal capsules, and that they are carried into the circulatory stream after penetrating into the interior of the veins. P. Manasse (Revue des Sciences Méd., July 15, '94).

The melanodermia of Addison's disease is to be observed whenever the periphery of the organ, the cortex, the nerve-filaments, or the ganglia of the region are involved. On the other hand, it is difficult to distinguish which phenomena are due to toxæmia. Bedford Fenwick, Greenhow, Jürgens, Kalindero, Babès (Brit. Med. Jour., Mar. 30, Apr. 6, '95).

Etiology. — Well-marked cases of melasma suprarenale are of comparatively rare occurrence in this country. Of the cases on record, much the larger number were in persons between the ages of 20 and 40 years; and more than 60 per cent. were in the male sex. Greenhow collected 183 cases, of which 119 were males and 64 females. Belaiëff has recorded one congenital case, the child living eight weeks after birth, the skin presenting a yellowish-gray color, and an autopsy showed the suprarenal capsules enlarged and filled with cysts. Another case has been reported in a child only 8 days old. Its skin was "mottled and yellowish brown." An autopsy revealed enlargement and congestion of the middle third of the right suprarenal capsule, and hæmorrhage with caseous degeneration in the left.

Records collected of 48 cases of Addison's disease occurring during childhood. Youngest child was 7 days, eldest 14 1/2 years. The affection, almost invariably due to tuberculosis, is usually first manifested by vague symptoms, such as weakness, anæmia, loss of weight, gastro-intestinal symptoms, nausea, vomiting, and diarrhœa. Pain and pigmentation are quite uncommon in children. Convulsions are usual, intermissions frequently occur, and the disease pursues a more rapid course than in adults. Dézirot (Jour. de Méd., Aug. 28, '98).

Addison's disease in a 3-year-old child. It was taken quite suddenly with diarrhœa, gastric disturbance, and prostra-

tion. At the end of three days asthenia was marked, and there were complaints of pain in the upper part of the abdomen and lumbar region. The vomiting, elevated temperature, and the character of the pulse pointed to a peritonitis. A slight pigmentation of the abdomen was all that suggested Addison's disease, but the previous history of the patient did not support such a diagnosis. At the autopsy an ancient tuberculosis of the suprarenal capsules was found. Peyer's patches were swollen, but not ulcerated. The spleen, which was enlarged, furnished a pure streptococcic culture. The case is interesting from what appears an acute Addison's disease, the more pronounced symptoms of which developed coincidently with a general streptococcic infection. Netter and Nattan-Larrier (La Presse Méd., May 2, 1900).

On the other hand, one or more cases have been recorded as occurring as late in life as 70 years.

As predisposing causes, we find enumerated excessive physical labor, mental anxiety and depression, caries of the spine, confinement in damp and ill-ventilated rooms, insufficient food, blows upon the abdomen, and tuberculosis of the peritoneum. Greenhow claimed that nine-tenths of the cases collated by him had occurred among the laboring classes. Nearly all the conditions mentioned as predisposing causes are the same as are generally alleged to predispose to pulmonary and other varieties of tuberculosis. The more efficient or direct cause of the disease under consideration appears to be an interruption of the functions of the suprarenal capsules. According to Lewin, some degree of structural disease of these capsules is found in 88 per cent. of all the cases, and the most frequent of these changes is tubercular.

Tuberculosis is the most frequent and important change in the adrenals in Addison's disease. The various other changes in these bodies—as chronic inflammation, caseation, or calcareous infiltration—are to be regarded only as the different results of the tuberculosis. Alezais and Arnaud (Revue de Méd., Apr., '91).

Typical case in which the suprarenals were both enlarged and cheesy, the abdominal sympathetics being enlarged and red to the naked eye, associated with pulmonary tuberculosis and Pott's disease of the spine. Tyson (Univ. Med. Mag., Sept., '91).

It has been proved that the etiological factors underlying Addison's disease are not dependent upon the presence or absence of the adrenals alone. The chief symptoms of Addison's disease can be produced by lesions of ganglia in close association with the adrenal blood-supply. A. F. Jonas (Annals of Surg., Apr., '98).

Analysis of several cases tending to suggest that certain toxic substances, such as pyrocatechin, phosphoric and lactic acids, are developed in the intestines and muscles, and that these are altered in the suprarenals and there prepared for excretion. When for any reason the suprarenal tissue is destroyed, these substances will remain in the system and lead to a chronic intoxication. I. Huismans (Münch. med. Woch., Mar. 27, 1900).

History of a family in which the mother with her first pregnancy had begun to show pigmentation. With each subsequent pregnancy she had become more pigmented and more depressed, and at the time of the report she had marked disturbance of the gastro-intestinal tract, with irregular pains, attacks of giddiness and syncope, and numerous almost black spots resembling moles over the body. Four children showed similar symptoms, decreasing in degree and severity directly with their youth. The cases were distinctly Addison's disease, but tuberculosis might have existed in the whole family and have involved the suprarenal glands. Family involvement in Addison's disease has been rarely noted. R. A. Fleming and J. Miller (Brit. Med. Jour., Apr. 28, 1900).

Pathology. — The post-mortem examination of the case reported by Jonas,

in addition to the bronzed spots on the surface, the cavities of the heart moderately filled with blood only partially coagulated; the liver and spleen of natural size and color; the mucous membrane of the stomach and ileum congested, softened in some places with abrasions; and the suprarenal capsule much enlarged. No other morbid appearances were noticed in the abdominal viscera. An incision through the centre of the suprarenal capsules revealed a central caseous mass in each, of the consistence of new cheese, about thirty millimetres in diameter, inclosed in a sac of gray, fibrous tissue, with some spots and streaks of yellowish color. On the surface of the caseous mass next to the surrounding capsule was a thin layer of a creamy consistence, and the fibrous capsule under the microscope showed the presence of fusiform, lymphoid, and large granular or giant cells in considerable numbers. Both capsules presented the same appearance and were undoubtedly good specimens of tuberculous disease.

The two most constant anatomical changes found in Addison's disease are the pigmented spots consisting of granular pigment deposited in the deeper layers of the rete Malpighi and the caseous or tuberculous degeneration of the suprarenal capsules. Of 375 cases collected by Lewin, in 288 the suprarenals were found tuberculous, and in many other cases they were affected with inflammation, cysts, atrophy, carcinoma, or sarcoma.

Case in which the tubercular nature of the lesions in the suprarenal bodies was demonstrated. Death took place with absolute suddenness. The autopsy showed slight evidence of tuberculosis of the lung. One suprarenal capsule presented a very pronounced caseation, and was large and lumpy. In the other the lesion was much less pronounced. The capsule was not greatly enlarged, but its normal tissue had disappeared, and its place was taken by a general, homogeneous, tough tissue, in which were a few caseous centres. Microscopical examination demonstrated that the lesion was tubercular, and there were tubercular bacilli in the capsules. The bacilli were not numerous, but unequivocal. Joseph Coats (Glasgow Med. Jour., Aug., '92).

Five cases of Addison's disease which had been examined, first clinically and afterward post-mortem. In all of them the suprarenal capsules were found diseased. In four they were extremely tuberculous, three showing the disease on both sides, and one on one side only. In the fifth case there was a carcinomatous degeneration of the left suprarenal as well as left-sided pulmonary cancer. Posselt (Centralb. f. klin. Med., Feb. 5, '95).

Case of Addison's disease in a boy, 14 years old, suffering from old pulmonary tuberculosis, with recent miliary outbreak; considerable epigastric pain during life. No pigmentation of skin. Post-mortem disclosed, in addition to lung condition, enlarged and pigmented bronchial glands, enlarged and firm mesenteric glands, with congestion of liver, kidneys, spleen, and intestines. Capsules of suprarenal bodies were thickened and adherent to surrounding tissues. Each suprarenal body was four times normal size. On section they were caseous, and contained cretaceous nodules. Microscopically mesenteric glands showed small-cell infiltration without giant-cells. Periphery of suprarenals was rich in typical small tubercles, many containing large, multinucleated giant-cells. Signs considered of diagnostic importance were extreme asthenia, emaciation, anorexia, vomiting, abdominal pain, and small, rapid pulse. J. Anderson (Lancet, June 18, '98).

Autopsy of a case of Addison's disease in a girl who had had tuberculous cervical glands and tuberculosis of the lungs, with brownish skin and extreme anæmia. Both adrenal bodies were

found infected with tuberculosis. The object of the adrenal bodies is to absorb certain toxic substances manufactured in the intestines. Huismans (Münchener med. Woch., Apr. 2, 1901).

Next in frequency to the suprarenal capsules, the ganglia of the sympathetic system of nerves have been found altered in structure, especially in the neighborhood of the capsules. In many cases structural changes have been found to co-exist in both the capsules and the ganglia of the sympathetic in the same patients.

On the other hand, a few cases have been reported presenting all the clinical symptoms of Addison's disease, in which the autopsy failed to find any structural changes in either the suprarenal capsules or the nerve-ganglia.

Case in which the typical changes were encountered, and in which there was found a chronic spinal sclerosis of the posterior root-zones, with a neuritis attacking especially the posterior roots of the spinal nerves. Marked by a swelling of the axis-cylinders, their rupture at places, and a multiplication of cells. Kallendro and Babès (La Semaine Méd., Feb. 22, '89).

[The cases of adrenal involvement without co-existing pigmentary changes lend considerable weight to the assertions of those pathologists who find Addison's disease rather a disease of nervous origin than one involving a glandular organ. This opinion is further strengthened by the finding of pigmentary changes in cases presenting no demonstrable change in the adrenals. Another point of no slight weight may be taken in the suggestion of Jürgens, that at least a certain class of pigmented instances are due to peripheral nervous irritation, possibly from epithelial degeneration or actual external irritation, mostly met about the flexures, folds, and in the face, from exposure. This last suggestion is further borne out physiologically from the pigmentation often caused by the constant wearing of even non-metallic objects, as buttons, next the skin.

The opposite view—*i.e.*, of glandular destruction — cannot, however, be set aside, numerous careful observations and the results of various experimenters offering weight in this direction.

As to the nature of growth found in the suprarenals, there can be but little doubt that other new formations than tuberculosis are attended by the complex of symptoms of Addison's disease. Tyson and Smith, Assoc. Eds., Annual, '89.]

Investigations upon rabbits and dogs showing that the adrenals stand in intimate relation with the central nervous system, and that their affection is the cause of the train of phenomena known as Addison's disease. Tizzoni (London Med. Recorder, Feb., '90).

Case in which, associated with the ordinary symptoms, there occurred a sudden attack of bromidrosis, indicating a rather serious involvement of the sympathetic nervous system. Ohmann-Dumesnil (Atlanta Med. and Surg. Jour., July, '90).

Six cases of adrenal caseation, in some of which there was distinct round-celled infiltration of the semilunar ganglia without bronzing of the skin. Addison's disease cannot be said to be directly due to changes in the sympathetic abdominal ganglia, although, perhaps, this or that symptom of the affection may depend on such involvement of the sympathetic ganglia. Von Kahlden (Münch. med. Woch., June 23, '91).

Not the great sympathetic nerves and ganglia, not the suprarenal capsules themselves, but the pericapsular nerve-ganglia constitute the especial starting-point for the development of the symptoms of Addison's disease. Alezais and Arnaud (La Semaine Méd., Oct. 7, '91).

Four autopsies suggesting that the disease is due to irritation of the abdominal sympathetic from direct lesion of the nerve, its ganglia, or the suprarenal capsules. This lesion is most frequently primary or secondary to tuberculosis of the capsules with secondary involvement of the sympathetic. In less than 20 per

cent. it is not tuberculous, and in 12 per cent. of the cases the capsules remain normal. Thompson (Amer. Jour. of the Med. Sciences, Oct., '93).

To be regarded as a functional whole, the cortex and the medulla doing the same work, but in unequal degrees. Atrophy of the suprarenal capsules occurs normally in old age, but may occur earlier in life and cause Addison's disease. Hæmorrhage into the substance of the gland may be due to traumatism either later in life or in infants at birth. Fatty and lardaceous degenerations occur. The glands have been found to contain cysts. Out of one hundred and thirty-one cases in which death was due to tuberculosis, the glands were tuberculous in eighteen, without, however, there being any signs of Addison's disease. Rolleston (Lancet, Mar. 23, '95).

The primary morbid conditions or processes on which depend the development of the clinical phenomena of Addison's disease have not yet been so clearly demonstrated as to remove the subject from the fields of controversy or doubt.

Much the larger number of writers incline to agree with Dr. Addison, who ascribed all the essential symptoms and results of the disease to interruption of the function of the suprarenal capsules caused by some form of disease in those organs. Those holding this view assume that these bodies either destroy some toxic element resulting from natural metabolic changes in the blood or tissues, or secrete and return to the blood some substance necessary for the maintenance of health.

Pyrocatechin, found in the medulla of the suprarenal gland, becomes brown in contact with air or alkaline tissues. It is converted in Addison's disease into a poisonous compound on leaving the suprarenal body and entering the circulation. In health the elimination of pyrocatechin occurs through the agency of the sympathetic ganglion-cells. The debility, etc., are the signs of chronic poisoning with pyrocatechin: an autotoxication. Mühlmann (Münchener med. Woch., Feb. 16, '96).

Certain changes in the suprarenal capsules—such as hyperæmia, hypertrophy, etc.—are noted when certain poisons are introduced into the system, especially if slowly given: cloves, toluene-amin, toxins of bacilli, etc. (Roux and Yersin, Roger, Pilliet, Charrin and Langlois.)

The toxic power of the extract of suprarenal capsules was noted by Foà and Pellacani (1884), and has been examined since then by many authors. It causes a rise in the blood-pressure combined with slowing of the heart. (Cybulski, Olivier and Schäfer.)

Capsules which are affected with hyperæmia still contain the principle which gives rise to the above effect (not pyrocatechin); but capsules hypertrophied to double or more their original size no longer contain it. P. Langlois (Arch. de Phys., vol. viii, p. 152, '96).

The suprarenal capsules are intended for the destruction of the red blood-corpuscles, which give up their hæmoglobin to the medullary cells of these organs under the form of pigment. Blood poisons—such as formol, aniline products, mineral poisons, sodium nitrate, and uranium nitrate — cause congestion of the capsule, excess of pigment in the cells of the medullary region, and hæmorrhages into the same region. The blood passes through the capsule from the centre toward the periphery, giving up its hæmoglobin to the medullary substance or to the deeper portion of the cortical substance. When the gland has taken up all it can, other mesodermic elements assume its functions, such as white blood-globules and connective cells of the skin. This gives rise to the pigmentation of the skin in certain destructive lesions of the capsule. A. Pilliet (Arch. de Phys., vol. vii, p. 555, '96).

Brown-Séquard claimed that the pigment derived from the disintegration of red corpuscles of the blood was destroyed in the suprarenal capsules. If this is true, any disease affecting them sufficiently to suspend their function should

be followed by increased pigmentation and possibly give rise to all the other symptoms of the general disorder.

Two cases of Addison's disease: one a typical instance of caseous degeneration of the adrenals with melanoderma, the other one of malignant disease of the suprarenals without discoloration of the skin. In both cases the blood-count was high. In the first the red corpuscles numbered from 6,500,000 to 7,200,000; in the second, 5,400,000. A. A. Christomanos (Berliner klin. Woch., Oct. 16, '99).

Experiments on animals for the purpose of determining the real functions of the suprarenal bodies by several investigators have resulted so variously as to lead to contradictory conclusions. After total extirpation of both suprarenal capsules in one hundred and fifty-three animals no changes in pigmentation or other symptoms of Addison's disease were observed. (Nothnagel.)

In neither of these cases, however, are we informed as to how long after the extirpations the animals were kept under observation. On the other hand, Tizzoni, who kept rabbits alive two and three-fourths years after crushing the adrenals, claimed that pathological pigmentation and some multiple degenerations in the spinal cord developed. The experiments of Abelous and Langlois also appear to prove that animals deprived of these bodies die with symptoms of toxæmia.

The symptoms of the affection indicate an intoxication, the experiments of Abelous and Langlois having shown that animals deprived of the capsules die poisoned, and that their blood shows a special toxicity. If a small portion of the suprarenal parenchyma be retained, the intoxication is neutralized and life remains possible. In Addison's disease, adynamia, gastric disturbances, and the terminal symptoms of cardiac collapse (hypothermia and coma) appear to be purely toxic phenomena, although these have not always been provoked with hypodermic injections of suprarenal juice. All the symptoms do not depend upon intoxication, however, the pigmentation of the skin and mucous membranes being in relation to lesions of the sympathetic. Chauffard (La Semaine Méd., Feb. 14, '94).

One of the functions of the capsules is to destroy a part of the used-up red corpuscles. If this excretory or depurative function is interfered with, the circulation of the decomposition products of hæmoglobin causes Addisonian poisoning. Rôle attributed to the medullary substance. The rôle of the cortical substance is that of furnishing a secretion that is taken up by the lymphatics, and which is indispensable to the needs of the organism. Auld (Brit. Med. Jour., May 12, '94).

[Auld thus appears to assign to the suprarenal bodies a double function. N. S. Davis.]

The suprarenal bodies elaborate a substance which has a very powerful action on the muscular tissues and more especially on the muscular coat of the arteries. It causes, in very small doses, an enormous heightening of the blood-pressure, dependent upon contraction of the peripheral vessels, due to a direct action of the substance on the muscular coat, and not to any action on the medullary vasomotor centre. It also acts directly on the heart, producing augmentation and acceleration, provided the vagi are divided. On the voluntary muscles its action is such that the period of contraction is slightly and the period of relaxation greatly prolonged. On respiration more marked effects are obtained in rabbits than in dogs. In cases of Addison's disease no physiological action from the extract of the diseased capsules obtained. It is possible that the phenomena of Addison's disease are due to the absence of this active principle. Schäfer and Oliver (Practitioner, Sept., '95).

Results of experiments on one hundred and nine rats from which both suprarenal capsules were removed, and others in which these bodies were cauterized or otherwise inflamed. After the

lapse of a few months a large number of these animals showed an infiltration of the pigment in the subcutaneous cellular tissues, in the lumbar and mesenteric glands, in the peritoneum, mesentery, liver, spleen, and lungs. Muscular paresis had developed in some of them with increasing asthenia; and the injection of an extract from the muscles of such rats proved fatal to other rats. Boinet (La Semaine Méd., No. 8, '96).

This view of the functions of the capsules, in connection with the fact that some form of disease has been found in them in nearly 90 per cent. of all the cases on record, certainly points directly to interference with or interruption of such functions as the first link in the chain of pathological processes constituting the disease under consideration.

Another class of writers and investigators, however, finding evidence of structural changes in a considerable number of cases of Addison's disease in the ganglia of some parts of the abdominal sympathetic system of nerves, have claimed that these changes are the primary pathological steps, and that all the general phenomena result from trophic influences. Prominent among those advocating this view are Riesel, Burgen, and W. G. Thompson, while Alezais and Arnaud claim that the primary seat is neither in the ganglia of the sympathetic nerves nor in the suprarenal capsules proper, but in the pericapsular nerve-ganglia themselves.

Case in which there was a sudden and maniacal attack the day before death, lasting several hours, dissections showing caseous suprarenal bodies and the thickening and matting of the tissues in the neighborhood of the semilunar ganglia and solar plexuses. Lindsay Steven (Lancet, Oct. 31, '96).

Certain vasodilator fibres run in the splanchnic nerves to the adrenals. In the dog the splanchnics, after traversing the diaphragm, give off on each side, before they enter into the formation of the solar plexus, a single large branch to the adrenals; these are thought to contain the chief vasodilator fibres, since, if divided, stimulation of the splanchnics in the thorax is without influence, while stimulation of the distal extremities of the divided nerves is followed by active hyperæmia. Arthur Biedl (Pflüger's Archiv, June, '97).

The theories of the changes in the great sympathetic system and of insufficiency of the capsules which have been opposed to one another as an explanation of the cause of Addison's disease each contain some truth, but are too exclusive. Where the capsules are either absent or not diseased, only the nervous theory can be upheld. Clinical research and experiments prove that pathological or experimental destruction of the capsules acts not only by the ascending and secondary degeneration of the great sympathetic and its ganglia, but also by capsular insufficiency.

This suppression of the action of the capsules favors retention in the blood, viscera, and muscles of toxic products which appear to play a certain part either in the formation of pigment in the blood or in the production and increase of the asthenia. E. Boinet (Revue de Méd., Feb., '97).

In this connection it is proper to state that F. Marino-Zucco, Director of the Chemico-Pharmaceutical Institute of Genoa, has obtained neurin from the normal suprarenal capsules in notable quantity, and has detected the same substance in the urine of a patient with Addison's disease. This, with further experiments with neurin, led him to regard the retention of this substance, on account of disease of the capsules, as the probable cause of the more general disorder. The results of the more recent active investigations concerning the functions of the thyroid and other ductless glands, and the therapeutic effects of extracts derived from them, add to the probability that the statement we

have quoted from Auld will be found correct. That the suprarenal capsules contain true glandular structure, and also an abundance of nerve-ganglia and filaments connecting freely with the abdominal sympathetic system of nerves, was fully demonstrated by Henle and von Brunn.

The existence of a true glandular structure plainly implies a secreting or transforming function, the suspension of which would lead to some kind of metabolic disorder, while the close nervous connection with the sympathetic would explain the coincident gastro-intestinal disorders and progressive asthenia. This pathological view also enables us to see why the clinical phenomena constituting Addison's disease may be developed, not exclusively by tuberculosis or any one special disease, but by any and every morbid condition capable of persistently interrupting the natural function of the suprarenal bodies.

Case in which autopsy revealed congenital absence of the suprarenal capsules. No other lesions were found. Only two similar cases reported. Patient was 24 years old; the symptoms were melanoderma, pains, progressive asthenia, wasting, cachexia, and gastro-intestinal disturbance. Ended fatally in ten months. A. Rispal (Third French Med. Cong.; N. Y. Med. Record, Sept. 19, '97).

Case of Addison's disease with simple atrophy of the adrenals in which, though the histological changes were comparatively slight, the symptoms of Addison's disease were well marked and fatal. The cutaneous pigmentation appeared fourteen years before the onset of the profound constitutional symptoms. Carlin Philips (Jour. of Exper. Med., vol. iv; Practitioner, May, 1900).

Prognosis. — Until very recently the prognosis in well-characterized cases of Addison's disease has been uniformly regarded as unfavorable. It is true that a very few cases of recovery have been reported, but nearly all writers of the highest authority regard such as examples of mistaken diagnosis. "An absolutely fatal prognosis must always be made. In all these cases which are recorded as having been cured there exists a doubt as to the accuracy of the diagnosis." (Merkel.)

Osler, in 1894, declared that the disease was fatal in every case. In the meantime, encouragement by the results of the use of the thyroid gland or extracts from the same in cases of acromegaly led Oliver and others to use extract of the healthy suprarenal capsules in the treatment of Addison's disease, and with so much benefit that in the second edition of his work, in 1895, Osler had modified his previous declaration by saying: "The disease is *usually fatal.* . . . In rare instances recovery has taken place, and periods of improvement, lasting many months, may occur."

Case of recovery in a man of 57 years who, in April, 1885, was suddenly attacked by weakness, anæmia, pigmentation of the mucous membranes, bronzed skin, and, a little later, pain in the region of the capsules. Strength returned little by little; so that in September, 1886, he was able to pass half an hour out of bed. At the same time the pigmentation grew less marked and gradually disappeared. At the end of two years the patient could be regarded as cured, and recovery has since been maintained. H. Neumann (Deutsche med. Woch., Feb. 1, '94).

As the disease, in a large majority of the cases, has been shown to be tuberculous, there is no reason why some cases may not recover, as well as in some cases of tuberculosis of the lungs or other structures. A very guarded prognosis, however, is most judicious in all cases of this disease.

Treatment.—The tendency of medical investigators, in the last two or three

decades, has been to seek for some one specific cause for each disease and for each a specific remedy. This has caused the careful consideration of the influence of predisposing causes to be more neglected; less attention to be given to the influence of co-operative causes, especially in the production and maintenance of chronic diseases; and less appreciation of the effects of retained excretory products during the progress of diseases, both acute and chronic, and of consequent changes in therapeutic indications in different stages of progress. In accordance with these tendencies most recent writers have devoted but few words to the consideration of the treatment of Addison's disease. Not being able to identify the specific or essential cause, we are assured that no specific remedy has been found, and that the treatment must be hygienic and palliative: *i.e.*, we must endeavor to improve nutrition by suitable diet, and to mitigate the more important symptoms as they arise. The truth is, however, that very few chronic diseases arise from, or are perpetuated by, a single specific cause. Contrarily, most of them are readily traceable to the co-operation of several causes, some of which are called predisposing and others exciting factors. And even in the few chronic diseases that have been traced etiologically to a specific exciting cause or pathogenic germ, as tuberculosis of the lungs, it is generally admitted that the specific germ alone rarely proves efficient in developing the disease without the aid of such predisposing factors or conditions as had diminished the natural vital resistance of the system or of the organ attacked.

In the treatment of all such cases, therefore, it is very important that we investigate carefully the history of each patient that we may appreciate whatever predisposing influences had been operative, and execute such measures as will prevent their further influence. In the early stage of Addison's disease the patient should be relieved as much as possible from both hard physical labor and mental anxiety, and given free access to pure air of genial temperature and a fair variety of digestible food.

As the autopsies reported have shown the presence of tubercular degeneration, not only in the suprarenal capsule, but also in other structures in a majority of the cases, patients should be encouraged to go early to mild and dry climates at moderate elevations, and to take persistently such remedies as have been most beneficial in the more common forms of tuberculosis. Of these, perhaps, for protracted use none are better than creasote, in some form, and nuclein, as they are both antiseptic and tonic to the digestive and assimilative organs. If the creasote is given in capsules, $^1/_{30}$ grain of strychnine, added to each dose, will aid in sustaining the functions of the cardiac and vasomotor nervous systems. Arsenic has been strongly recommended in such cases as will tolerate it in large doses without disturbing the stomach and intestines. In one case under my care the patient appeared to derive much benefit from potassio-tartrate of iron, given in moderate doses in connection with digitalis. In the later stage of the disease, when the asthenia is profound, the patient should be kept much in the recumbent position, and his gastric and intestinal disturbances combated by the use of bismuth subnitrate, cerium oxalate, and sometimes creasote with codeine.

Since it has been ascertained by very careful experiments that the healthy suprarenal capsules contain an active substance capable of producing a decided stimulant and tonic effect on the cardiac and other ganglia of the sympathetic

nervous system, and of efficiently increasing the vasomotor functions with slow heart-beat and greater blood-pressure, their use in the treatment of Addison's disease has been tested, more or less, by almost every physician having a case under his care. Oliver, who has been most active in investigating the action of preparations of the suprarenal capsules and their value in the treatment of Addison's disease, says they may be used in the form of alcoholic tincture and of either fluid or dry extract. The best mode of administration is by the mouth, and of the dry extract in the form of tablets of 2 1/2 grains each, one of which may be taken three times a day, and slowly increased to five or six in the twenty-four hours.

Case of a man, 46 years of age, suffering from pulmonary tuberculosis and Addison's disease with marked pigmentation of the skin and of the mucous membrane of the palate, treated with an extract prepared from the fresh suprarenal glands of the pig extracted and preserved in glycerin. One drachm of the extract correspond to one suprarenal gland, and the patient at first was given 1/2 drachm three times a day. This treatment was continued for eight months, and the patient was discharged in a greatly improved state, having gained in weight and strength and the pulse-frequency being much lessened. Four months later the patient was still in good health. William Osler (Inter. Med. Mag., Feb., '96).

Forty-eight cases of Addison's disease from literature, which were treated with adrenal gland. Of these, 6 seemed cured, 22 were improved, 18 unimproved, and 2 became worse. In many of the cases there was such a grave tuberculosis of other organs as to preclude expectation of marked improvement. F. P. Kinnicutt (Amer. Jour. Med. Sci., July, '97).

Man of 49, with well-marked Addison's disease, treated with tablets of suprarenal gland, beginning with 10 grains daily and increasing up to 200 grains. At the end of the year the man was entirely well. C. W. Suckling (Brit. Med. Jour., May 28, '98).

Case of Addison's disease in all respects very typical, and in addition a small phthisical lesion at apex of one lung. He was given daily 3 3/4 to 12 1/2 drachms of fresh suprarenal glands of beef, veal, or mutton, and also during some part of the time hypodermic injections of solution of suprarenals in glycerin and water. For five months there was no obvious improvement. After further lapse of time strength began gradually to return and pigmentation to diminish in intensity, so that finally he was able to resume his employment, and was still at work three years later. Béclère (Semaine Méd., Mar. 2, '98).

Case of Addison's disease treated with the fresh suprarenal gland, with distinct improvement of general health, but pigmentation remained unchanged, and patient died two years later. Hayem (Sem. Méd., Mar. 2, '98).

Case of Addison's disease in a man aged 54 years. The symptoms of the disease were marked. One-twelfth grain of the extract of suprarenal glands of sheep was given three times daily. Treatment has been continued for two years at intervals. Asthenia, nausea, faintness, and pigmentation have almost entirely disappeared. Twice, when the extract could not be obtained for ten days, attacks of severe faintness, clammy sweats, and muscular twitchings, with fever and bounding pulse, resulted; they were relieved on the exhibition of the drug. R. A. Bate (Amer. Pract. and News, vol. xxviii, p. 90, '99).

Suprarenal extract should be tried in all cases. There is little hope in cases of tuberculous origin; in those due to atrophy, sclerotic or inflammatory changes; but, if a portion of the gland is still active, the extract will probably be found beneficial. J. V. Shoemaker (Jour. Amer. Med. Assoc., Mar. 23, 1901).

Eight cases of Addison's disease treated with adrenalin. This treatment is contra-indicated in severe and advanced cases of Addison's disease, as there is danger from the subcutaneous

injections when only a small part of the parenchyma of the suprarenals is still intact and able to fulfill its physiological task. Even in recent and early stages of the disease the dose should never be more than $^1/_3$ milligramme. In these early cases we may anticipate that in these small doses the adrenalin will stimulate the still sound portions of the gland to compensating hypertrophy. It is better to fraction even this dose, and the medication should be suspended if tremor or other indications of intolerance supervene. The longer it is continued, the smaller the dose should be and the longer the intervals. An aqueous glycerin extract is the best preparation for the purpose, made according to the Brown-Séquard method, not surpassing the dose of 1 cubic centimetre, supplemented, possibly, by ingestion of some other preparation of the glands in the intervals between the subcutaneous injections. It may be preferable to substitute oxyadrenalin, which is only one-tenth as toxic as adrenalin itself. Six of the eight patients were very much improved after an average of 200 subcutaneous injections of the glycerin extract of suprarenal capsules; but two others in more advanced stages died in from two to four days after this treatment had been instituted. Boinet (Bull. de l'Acad. de Méd., vol. lxvii, No. 39, 1903).

Grainger Stewart, McCall Anderson, and other observers have reported cases treated with the suprarenal extract without benefit.

Case of Addison's disease treated with suprarenal extract. Much improvement took place during the first four weeks, after which the failure was rapid until death occurred. Reference to 9 other cases recorded in which improvement had taken place in 5, in 2 no improvement, 1 died early, and 1 continued treatment but a few days. Sydney Ringer and A. Phear (Brit. Med. Jour., Jan. 18, '96).

Typical case in which the patient had been taking suprarenal capsule by the mouth for some time. The only apparent effect was that the temperature, which had been subnormal, had returned to normal. T. R. Bradshaw (Lancet, Oct. 31, '96).

Administration of suprarenal extract in case of Addison's disease caused a disturbance of nitrogen-equilibrium, leading to increased consumption of body-albumins and to loss of weight. Max Pickardt (Berliner klin. Woch., Aug. 15, '98).

Suprarenal capsules administered subcutaneously to a case of Addison's disease; within twenty-four hours patient died with subnormal temperature and great prostration and collapse. P. Courmont (Quatrième Congrès Franç. de Méd. Int., '98).

Series of 43 cases of the disease collected treated with suprarenal extract; of these, 13 were improved, 9 recovered, 11 died, 3 showed no improvement, and the result was not recorded in 7. W. W. Johnston (Amer. Med. Congress; Brit. Med. Jour., June 2, 1900).

Case of a young man, 21 years old, who had suffered with this malady for eight years. When seen he had the characteristic weakness, being fatigued by the least effort. The skin of the face, hands, and back was pigmented. For several years the patient had taken suprarenal capsules in the form of tablets and subcutaneous injections. The medication had apparently met with no results. To this was added codliver-oil and arsenic. Little by little, strength returned and the extreme pigmentation disappeared. To-day there remain of the old symptoms only incontinence of urine and a slight weakness. The writer is of the opinion that gradual recovery will take place. Variot (Jour. des Practiciens, May 20, 1905).

Contradictory results having been obtained ever since preparations of the suprarenal capsules were first used in the treatment of cases of Addison's disease, it is impossible to determine the real value of this treatment, it being well known that a considerable proportion of the cases continue a number of years, though they often show periods of improvement. And for the same reason it

is not possible to determine whether the cases reported as cured will prove permanent or only temporary. Moreover, if the clinical symptoms and conditions constituting Addison's disease result from the interruption of the functions of the suprarenal capsules, there must have been a prior pathological condition causing such interruption. And, while we might reasonably expect the use of suprarenal extract to relieve the pigmentation and asthenia so long as its use was continued, unless it also removed this primary pathological condition, the asthenia and pigmentation would sooner or later return, certainly after the discontinuance of the remedy. The whole subject needs more careful and protracted investigation.

Removal of the diseased adrenal by surgical procedures is one of the latest means employed,—accidentally, it may be said, for the operation in the case reported had been performed for the removal of a malignant retroperitoneal growth that turned out to be a tuberculous suprarenal capsule.

> Case of recovery after removal of a tuberculous adrenal lying directly on the spinal column and appearing as a small, movable, firm, nodular tumor. Pressure over it brought on a characteristic attack of pain. The patient recovered in two weeks. All the symptoms disappeared after the operation. Eight months later no evidence of the disease could be discovered. Oestreich (Zeit. f. klin. Med., B. 31, p. 123, '97).

NATHAN S. DAVIS,
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ADENITIS.—Gr., ἀδήν, a gland; *itis*, inflammation.

Definition.—Inflammation of a gland.

Varieties.—Adenitis may be *acute*, due almost invariably to infection from an attack of angioleucitis and occasionally to injury or strains; or *chronic*, resulting from either of the preceding, especially in strumous or cachectic persons, and from slight sources of irritation, and not uncommonly resulting in permanent enlargement and induration or in tuberculous degeneration. Adenitis of specific origin will be described under SYPHILIS and URINARY SYSTEM.

Acute Adenitis.

Symptoms. — The general symptoms depend upon the extent and severity of the infection. Rigors may occur when pus forms. The temperature is frequently elevated. If the infection is severe, symptoms of profound septicæmia appear.

The local symptoms are, by far, the most prominent in the majority of cases, and consist of pain, heat, and swelling. The suffering varies from a slight soreness only to intense pain, according to the position of the gland, its relations with the surrounding tissues, and the density of the tissue in which it is imbedded. The heat may vary according to the degree of the congestion present. The swelling may either be great or slight. If the lesion be confined to the gland, it will be well defined; if periadenitis is present, the swelling will be more or less diffuse. Glands in any region of the body may be affected, but those of the neck, axilla, and groin more than the others; this is due to the fact that infection generally enters the system through the mouth, throat, genital organs, and the extremities.

In the congestive, or exudative, stage, pain and swelling are present in the region of the glands; if the glands are superficial the swelling is ovoid with the long axis coinciding with the direction of the afferent lymphatics, and palpation reveals several movable, hard, elastic, and tender rounded masses.

When the glands are deep, as in the

axilla, abdomen, or even the neck, the results of palpation are less definite and satisfactory.

In the suppurative stage the pain increases and becomes sharp and catching, the skin reddens, and the periglandular tissue swells.

If the gland alone suppurates the skin remains normal, while under it may be felt the softened and enlarged gland. This latter opens outwardly or into the neighboring cellular tissue on from the sixth to the fifteenth day of the affection. When the gland opens outwardly, the cicatrix is much smaller than when it ruptures into the cellular tissue, as in the latter case it gives rise to an abscess.

If the cellular tissue around the gland suppurates the skin becomes hot, swollen, and painful, and fluctuation may be felt. Two foci of suppuration are thus established. The skin is occasionally undermined by the pus. Recovery is possible, however, without suppuration of the gland.

Both the gland and the cellular tissue around it may suppurate, either simultaneously, or suppuration of the cellular tissue may precede that of the glands, or the latter may suppurate and rupture into the surrounding cellular tissue and form an abscess. Pus is usually produced in considerable quantity, and the affection is of long duration.

Suppurative adenitis may result in cicatrization after several weeks. This cicatrix may reopen to allow the exit of pus from a suppurated gland. On the other hand, a fistula may result, which may give exit to sero-pus or to lymph (Desprès). A lymphatic gland or vessel will then be found at the bottom of the abscess-cavity, below the crater-like opening.

As the suppuration usually starts in more than one focus in the gland, the first sensation to the touch will be one of bogginess, which periglandular congestion may render obscure. Well-defined fluctuation is found only when considerable tissue is destroyed.

Diagnosis.—The diagnosis of ordinary superficial acute adenitis is usually easy; it is more difficult when the neighboring cellular tissue is also inflamed; it may be impossible in cases of deep-seated or visceral adenitis.

In adenitis of the inguino-crural region the swelling is found in the external portion of the region if due to a lesion of the gluteal tissues, and in the inner portion of the region if due to a lesion of the anus, perineum, or external genitals. In both conditions the tumor will have its long axis directed more or less horizontally.

The swelling will be found in the lower portion of the inguino-crural region, with the long axis directed more or less vertically, if the lesion causing it is situated on the foot, leg, or lower part of the thigh. This disposition is due to the anatomical relations of the lymphatic vessels and glands, and should be borne in mind. Operation for strangulated crural (femoral) hernia has been performed for an adenophlegmon of the crural canal.

Etiology.—The lymphatic glands serve as reservoirs on the course of the lymphatic vessels, through which any irritants or infection must pass.

Cold and overexertion act as local depressants, and thus may indirectly favor the development of adenitis. General debility has the same effect. The following varieties of adenitis, etiologically regarded, are recognized:—

1. Adenitis by contiguity, resulting from the propagation, by contact, of a neighboring inflammation.

Three cases of suppurating inguinal glands accompanying gonorrhœa in which a bacteriological examination of the pus showed the presence of gonococci. Pure culture of typical gonococci obtained in one case; on being placed in the urethra of a healthy man this set up a characteristic gonorrhœa. In the two other cases, in which the abscesses opened spontaneously, examination of the pus from the fistulous tract showed the presence of gonococci and streptococci. An attempt to cultivate the cocci on Wertheim's medium, made in one of these cases, failed. Hansteen (Archiv f. Derm. und Syph., vol. xxxviii). (See URETHRA.)

2. Adenitis by continuity or following lymphangitis.

3. Adenitis by embolism, due to the transportation of septic or irritating matter, produced in the system or coming from the outside.

Adenitis of the mesenteric glands may be due to dysentery or to the inflammation of Peyer's patches in typhoid fever.

Adenitis occurs in carbuncle, furuncle, vaccination, erysipelas, and eruptive or infectious fevers.

Pathology.—If suppuration does not occur, resolution may take place, or chronic enlargement of the gland may follow hyperplasia of the connective-tissue stroma of the gland.

If suppuration does occur the surrounding connective tissue may, and usually does, suppurate; then the more or less disintegrated gland lies in a suppurating cavity formed by the circumjacent connective tissue.

There are two forms of acute adenitis depending upon the degree of inflammation present:—

1. Exudative adenitis. In this form the gland is swollen, and it feels hard and elastic. On section it appears reddish brown, like the spleen, with small foci of hæmorrhage, all of which indicate excessive dilatation of the capillaries. The lymphatic stream is arrested by the dilatation of the cortical lymph-sinuses and their obstruction by fibrin, granular material, and portions of altered white corpuscles. The lymph-follicles are filled with fibrin and accumulated lymph-cells. The stroma of the gland is swollen and infiltrated with cells.

If the section of the gland is scraped, a milky liquid will be obtained, which contains white corpuscles and epithelial cells, the latter showing several nuclei.

2. Suppurative adenitis. In this variety the gland softens, its tissues become more brittle, hæmorrhagic infiltration centres form that soon change into yellow, purulent foci. These, at first distinctly separate, soon unite, forming an abscess within the fibrous capsule of the gland. Sometimes the periglandular tissue suppurates, while the gland does not.

The glandular abscess and the periglandular abscess may open externally, each one separately or both simultaneously. The suppurating gland may rupture into the cellular tissue. Occasionally the gland is hard and elastic; it may be difficult to separate it from its fibrous capsule. The afferent lymphatics are enlarged and thickened. The lymph-cells and cortical follicles are few in number and have undergone granulo-fatty degeneration.

Seven cases of articular rheumatism in which the lymphatic glands situated above the affected joints were swollen and painful, the pain or tenderness increasing with that of the joint-affection. During the attacks some were of the size of a nut and rolled under the finger. No periadenitis or diffuse swelling was present.

In almost every case some previous infectious disease was to be found with which the chronic rheumatism could be connected. Bacteriological examinations, however, carried out either with the

intra-articular liquid withdrawn by aspiration or by fragments of glands removed aseptically, gave almost no results. A. Chauffard and F. Ramond (Rev. de Méd., May 10, '96).

Prognosis. — The prognosis is usually favorable; it may be unfavorable, however, when extensive abscesses form in the neighborhood of important organs.

Deep-seated suppurative adenitis may give rise to dangerous complications, especially in certain regions, like the neck and mediastinum, on account of the purulent extensions (through burrowing) and the difficulty of evacuating the pus.

Ulceration of the great vessels of the neck giving rise to grave hæmorrhages may also occur.

Treatment. — The first indication in acute adenitis is to remove any source of irritation or infection. Any wound, abrasion, opening, or any natural cavity with which either of these may connect should be so treated as to bring about absolute local asepsis.

If the case is seen early enough, cold applications should be made to the affected region. Cold inhibits the multiplication of bacteria, but when applied late it favors the death of cells, and should consequently be avoided.

The region in which the affected gland is situated should be kept at rest and, if possible, elevated. In this manner the afferent arterial current is diminished, while the efferent venous and lymphatic currents are increased.

To prevent suppuration gray mercurial ointment, very gently rubbed in, is useful. The injections of from 5 to 10 minims of a 3-per-cent. carbolic-acid solution into an inflamed gland have also proven satisfactory.

The connection between inflammatory conditions of the naso-pharyngeal space and acute infections of the glands at the angle of the jaw should be borne in mind. If promptly after the lighting up of the primary inflammation of the gland as evidenced by its enlargement, further absorption of infectious matter from the naso-pharynx can be prevented, the gland will cope successfully with the initial invasion and resolution occur, but if fresh invasions are allowed to take place resistance will be overcome and the gland will break down. Attention should therefore at once be directed to the problem of limiting septic absorption from the naso-pharynx by measures which keep the mucous membrane clean and also restore it as soon as possible to a normal condition.

Chlorate of potash has an almost specific action in limiting the pharyngeal inflammations of childhood, therefore:—

℞ Potassii chloratis, gr. i-ij.

Sig.: Every two hours for twenty-four hours, then every three hours, and later every four hours.

To cleanse and soothe the naso-pharynx:—

℞ Tablets alkaline antiseptic (Seiler).

Sig.: Dissolve one in a half-glassful of water and pour a little with a teaspoon into each nostril every three hours.

The results obtained from this line of treatment were immediately most gratifying. T. S. Southworth (Jour. Amer. Med. Assoc., May 30, 1903).

If it is desired to hasten suppuration, warm antiseptic fomentations are to be used in preference to poultices. The compound resin cerate of the pharmacopœia is effective for this purpose, and is antiseptic as well.

When pus has formed the gland should be opened by a generous incision, sinuses, if present, being opened throughout their entire length to facilitate treatment. The contents are then carefully removed, and the infiltrated wall scraped with a sharp curette. The cavity should then be packed with iodoform gauze, or gauze impregnated with camphorated naphthol or salol. The dressing may be removed on the third day.

In the treatment of cases of simple

chronic adenitis, applications of iodine, compression, and local blistering have given the best results.

Blisters, nitrate of silver, or iodine tincture should be applied around, but not over, the inflamed gland.

Excision may be performed if the mass be large or disfiguring.

> 1. Whenever fluid—that is, pus—can be detected in connection with a diseased lymphatic gland, the operation should be done before the skin becomes red and thin. 2. When the diseased gland is subcutaneous—that is, not beneath the deep fascia or muscle, and has been completely removed—the least scar will result if neither stitches nor drainage-tube be used, especially if it be possible to leave the wound uncovered by dressing and exposed to the air, so that the edges may be drawn and glued together by drying lymph. 3. If the diseased gland be beneath the muscle or muscular fascia, then a drainage-tube must be used and the edges of the wound must be united by suture. The best drainage-tube is the gilt spiral wire, especially as it may have to remain from two to eight or ten weeks, according to the depth of the wound or the completeness of the removal of the gland. 4. Where many glands have to be removed, it is better to remove them through a series of small incisions and thereby avoid very extensive ones. All sinuses and suppurating cavities should be thoroughly cleansed by means of scraper and lint, so as to leave a fresh surface free from granulation or decayed or decaying tissue, and that a drainage-exit should be maintained until all the deep parts are healed. Teale (Brit. Med. Jour., No. 1717, '93).
>
> Important to avoid tearing or wounding the gland in removing it, to keep close to its surface in order to prevent hæmorrhage, and to use transverse incisions. W. K. Treves (Brit. Med. Jour., No. 1717, '93).

Electricity, preferably the constant current, is highly recommended by some authors. Daily sittings of ten minutes each, using 5 to 15 milliampères, are required.

> The great majority of the cases of cervical adenitis are to be treated medically, since they only come under observation after suppuration has occurred. In the cases of tubercular adenitis which are not yet suppurating, extirpation through a small incision is indicated at once, with medical after-treatment to prevent recurrence. When one hard, caseous nodule exists, it should at once be extirpated, unless the resulting scar will cause marked deformity. When these are multiple, immediate extirpation is the treatment to be followed. Should the adenitis become purulent, extirpation is only indicated after all other methods of treatment have failed. Local injections are advised, with a long sojourn at the seashore, especially should fistulæ occur. Clean dressings must be applied to the fistulæ to prevent secondary infection. When extirpation is done, it should be complete. A. Broca (Jour. des Praticiens, Oct. 26, 1901).

Codliver-oil, the iodides, and iron are indicated in all cases when the digestive organs do not rebel against their use. Arsenic and strychnine are the agents next in order, and sometimes prove very effective. Out-of-door life and plentiful nourishment are of primary importance.

Chronic Adenitis.

Symptoms. — The symptoms vary according to the period of development in which the diseased gland is found at the time of examination.

Three periods of development are commonly recognized in tuberculous adenitis: the period of induration, or indolence; the period of inflammation; and the period of suppuration.

1. *Period of Induration, or Indolence.* —This period may last for years, and resolution may even take place, though the gland always remains somewhat enlarged and indurated. The glands are felt as hard, elastic, enlarged bodies,

rolling under the finger, with more or less distinctness as they are situated superficially or deep. No heat, pain, or redness of the skin is perceived.

2. *Period of Inflammation.* — In this period we have pain, redness of the skin, and tenderness on pressure. The gland, if solitary, may adhere to the skin. Fluctuation may be present.

3. *Period of Suppuration.* — In this period we notice much more softening of the contents of the gland than a real suppuration. The skin may ulcerate through almost without inflammatory symptoms, and the contents—consisting of caseous matter half-dissolved in a whitish watery fluid—may be evacuated. When periadenitis occurs, true pus may be present.

If chains of glands are tuberculous, the latter inflame alternately and discharge their contents in the same order, a series of abscesses being thus formed.

When the contents of the gland are discharged, the skin may become ulcerated in the neighborhood, form fistulæ, and a depressed, adherent, violet cicatrix finally form.

In some cases a fistula may form and last for years; the skin may be undermined, and disfiguring cicatrices may be formed.

Cretaceous transformation occurs at times in the deeper glands, but rarely in the superficial ones. Some caseous glands undergo a process which transforms them into a cyst-like cavity containing a serous liquid.

Chronic adenitis may assume various forms.

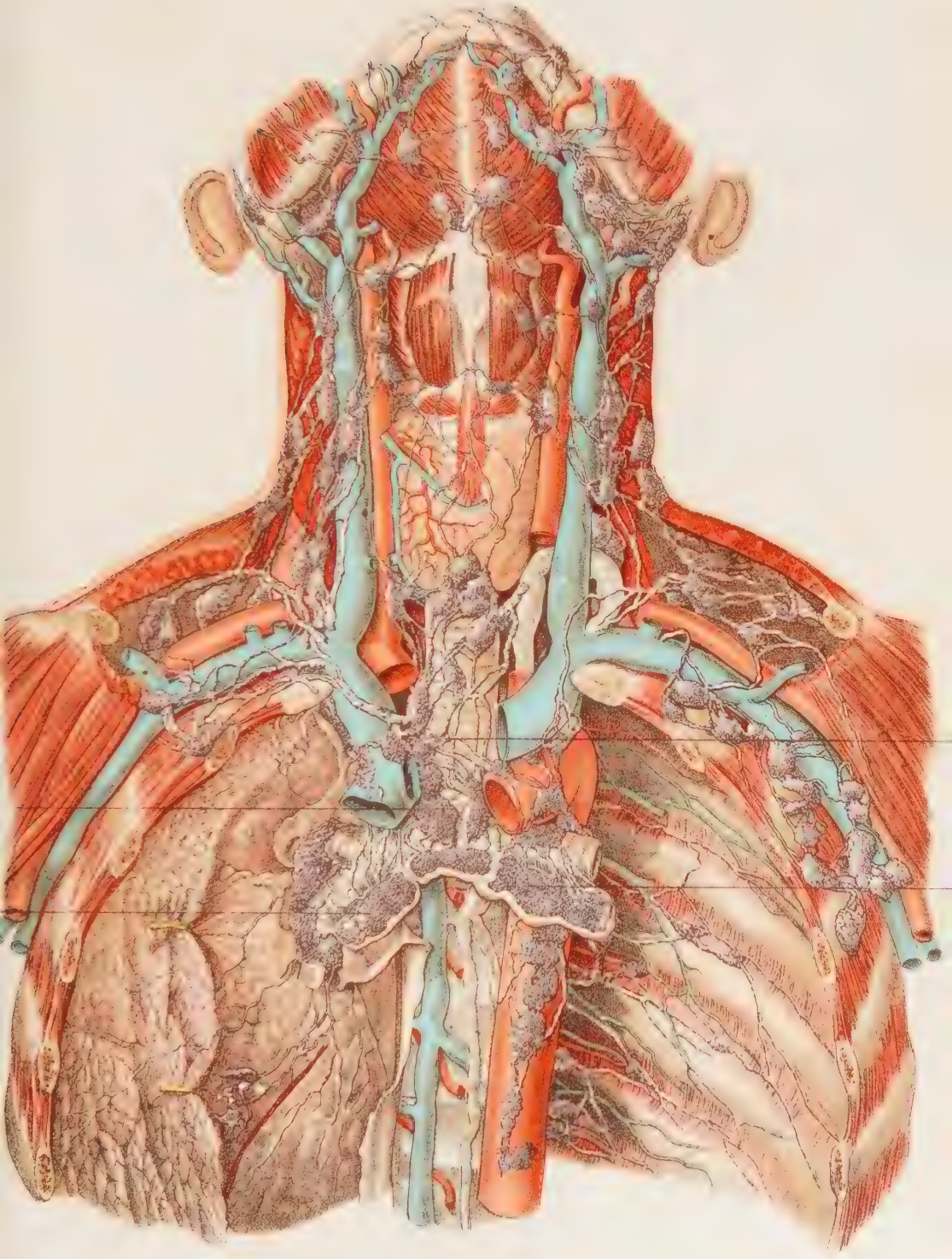
1. *General Tuberculous Adenitis.* — This presents itself especially in negroes. Organs other than the glands are but little affected, and continuous fever exists. The retroperitoneal, bronchial, and mesenteric glands are the most enlarged. It resembles, in many ways, an acute attack of Hodgkin's disease.

2. *Local Tuberculous Adenitis.* — (*a*) Cervical. This form is usually met with in children, and begins in the submaxillary glands, which are generally more enlarged on one side.

(*b*) Bronchial. This form is thought to be always secondary to a focus in the lungs, by some authors, but this opinion is contested by many others, Osler among them. Local lung-infection, pericardial infection, and general infection are to be feared, however.

(*c*) Peribronchial. In this form we must realize the importance of lesions resulting from caseation. There is a softening of the lymphatic glands situated around the lower end of the trachea and main bronchi. Evidence from percussion is of doubtful value; alterations in breath-sounds are much more important, especially when unilateral; divided respiration, with prolonged expiration, is found unaccompanied by any adventitious sounds. In cases in which the enlarged glands ulcerate through the air-tubes, the breath has a very offensive odor, and co-existence of fœtor with hæmoptysis and evidence of pulmonary consolidation are suggestive. When vomiting of blood and its passage by the bowel is added, the diagnosis of glands rupturing into bronchus and œsophagus is the most likely one. The annexed *colored plate* distinctly shows the anatomical relations of the peribronchial glands.

(*d*) Mesenteric. This form may be primary, and is thus very common in children, or secondary to local intestinal tuberculosis. The sufferers are usually weak and wasted; the abdomen is enlarged and tympanitic, and diarrhœa is a common symptom. Some fever is usu-



Cervico-Bronchial Lymphatic System. (Bourgery.)

a a a a Glands involved in bronchial adenopathy

ANATOMIE DU CORPS HUMAIN

ally present. This form may exist in adults. (Osler.)

The majority of children presenting symptoms of tuberculosis also have general adenitis, the swollen glands being felt everywhere; they never change in size or consistence. Suddenly a bronchitis develops, followed by a broncho-pneumonia, from which the child dies. Microscopical examination reveals caseous spots and the presence of tubercle bacilli throughout the affected glands. The name of "generalized peripheral adenitis" suggested for this condition. Grancher and Marinescu (L'Union Méd., Dec. 2, '90).

Diagnosis. — Chronic adenitis is generally limited to one or two glands; when the glands are tuberculous, chronic adenitis is apt to affect an entire mass. The former is often associated with an external simple lesion; the tuberculous form is apt to be more frequent in children, young soldiers, and negroes.

LYMPHADENOMA.—This variety of tumor is usually more voluminous and is not suppurative. The diagnosis, however, is exceedingly difficult.

SIMPLE ADENITIS.—This is an acute affection usually ending in a few days in suppuration.

SYPHILITIC ADENITIS.—When a primary sore is present, numerous, small, hard, indolent glands can be felt if the region is supplied with a chain of lymphatics. When in secondary syphilis there is glandular enlargement, a large number of external lymphatics take part in the process.

CARCINOMA.—The enlarged glands are small and hard, and can generally be distinctly traced to the growth.

LYMPHOSARCOMA. — This persists longer and is much larger before degeneration occurs.

Polyadenitis is a diagnostic sign of tuberculosis in children. Marinescu (Revue Men. des Mal. de l'Enfance, Mar., '91).

[As observed some years ago by Hutinel, the majority of children presenting symptoms of tuberculosis also have general adenitis. The swollen glands are to be felt everywhere, forming a general adenitis, and are found in regions where there is no other trace of tubercular involvement. Suddenly a bronchitis develops, followed by broncho-pneumonia, from which the child dies. ERNEST LAPLACE, Assoc. Ed., Annual, '92.]

In chronic adenitis the glands may become painful by the compression of small nerves, or of neighboring organs; when they are inflamed a small, hard mass usually appears, either alone or united with others, which may become enlarged and suppurate, or persist with practically no change for years, or finally disappear if the cause of irritation be removed.

Chronic adenitis is frequently a complication of malignant tumors. Supraclavicular adenitis appearing during the course of visceral cancer is usually situated on the left side (found twenty-seven times on that side by one author). It may be solitary or accompanied by adenitis in other regions; it usually appears late and develops rather rapidly. When occurring early it may be very useful for diagnostic purposes.

Twenty-nine cases of visceral cancer in which supraclavicular adenitis was present on the left side in twenty-seven. The symptoms are not very decided at first and the diagnosis may be more difficult. As to pathogenesis, it must be looked upon as due to direct propagation or to the formation of a cancerous embolism. H. Rousseau (Paris Thesis, '95).

From a clinical point of view this adenitis may be known by its ligneous hardness, its painlessness, its freedom from adhesions, and by the union into one solid mass of all the glands forming it.

Etiology.—This form of adenitis frequently follows some neighboring super-

ficial lesion, such as eczema, impetigo, conjunctivitis, or the exanthemata. Catarrhal inflammation of the mucous membranes predisposes to tuberculosis of the glands. The resistance of the lymph-tissue is weakened. This explains the frequent development of tuberculous bronchial adenitis after whooping-cough and measles, and of mesenteric adenitis in children with intestinal disturbances.

Cervical adenitis is not a manifestation of an already generalized tuberculosis; the bacillus penetrates, by solution of continuity of the mucous membranes or the skin, to the ganglion, which becomes a seat of infection. (Duhamel.)

A distinction should be made between hereditary (congenital) and acquired tuberculosis. In the latter case the author's views seem rational and correct, being comparable with and analogous to the phenomena observed in carcinoma and syphilis. When the infection is acquired there is, at first, a local seat, or focus, of infection in which the disease-germs develop and from which, after proliferation, they spread until the disease becomes more or less generalized, —the germs being transmitted through the lymphatic system to the lungs and thence in the blood-stream to the various organs of the body; the various glands along the course or path of transmission become affected and in turn become additional possible foci of infection. On the other hand, when the trouble is hereditary the glandular manifestation is an indication of an already generalized tuberculosis.

Youth predisposes to caseous adenitis on account of the predominance at that period of the lymphatic system. Crowding, humidity, and bad or insufficient food are also predisposing factors. Tuberculous adenitis is frequently observed in temperate regions. Negroes brought to such climates are especially prone to become sufferers.

The absorbent power of the lymphatic system is so great that the morbific principle of tuberculosis may be transported to the glands without visible external lesion of the skin or mucous membrane.

Axillary adenitis is frequently secondary to chronic tubercular lesions of the lungs. (Lépine.)

The cervical glands are occasionally found affected in phthisical patients.

> Proof of this has been lacking, and experimental attempts to induce tuberculosis of the cervical glands by introduction of tubercle bacilli into the tonsils have failed. J. Solis-Cohen (Amer. Jour. Med. Sci., May 9, '95).
>
> In post-mortem examination upon bodies of twenty-five tubercular patients tuberculosis of the tonsils was found in twelve, in every case in which the lymph-glands of the neck were also affected. Kruckmann (Virchow's Archiv, B. 138, '94).
>
> A considerable proportion of the cases of enlargement of the tonsils and of adenoid vegetations of the pharynx are tuberculous in nature. Dieulafoy (London Practitioner, July, '95).
>
> A suppuration of cervical glands may be derived from the pharynx, as a rule, without tuberculous lesion of that part. Eustace Smith (London Lancet, May 25, '95).
>
> Instance of tuberculous inoculation through a small wound on the chin by kisses of tuberculous mother. In this case cutaneous tuberculosis was followed by a tuberculous lymphangitis. Rémy (Jour. de Clin. et de Thér. Infantile, Mar. 14, '95).
>
> [If the mother were tuberculous, there is a reasonable doubt that her offspring was a "healthy child," as stated in the original article. C. Sumner Witherstine.]

Pathology.—Usually an entire group of glands is affected. The glands are isolated when the irritation and rapidity of growth are not great; this usually

occurs in secondary visceral adenitis. In other cases—especially when the glands are superficial, where the adenitis is primary—the glands are united into a large lobulated and irregular mass, the size of which may vary from that of a small nut to that of an orange.

If the adenitis follows a visceral tuberculosis the afferent lymphatics show, in some cases, signs of tuberculosis, as is the case in pulmonary and mesenteric tuberculous meningitis.

Two varieties of lesions are to be noted: 1. Lesions of chronic adenitis affecting the stroma and the elements of the gland, which becomes hypertrophied. 2. Specific lesions of tuberculosis, consisting in miliary granulation at first, ending in caseation. As one or the other of these two processes is the more prominent, so will the lesion vary in appearance. Deep adenitis is never so sclerous as the superficial variety, the latter being characterized by a more vigorous reaction.

On section of a gland in the early stage of tuberculous infection we find it redder than usual, though at times gray and somewhat translucent. The tuberculous granules may be perceived by a glass. They are formed from the vascular and lymphatic vessels found in the cortical and medullary portions, and resemble ordinary follicles, but contain many small cells. Caseation rapidly occurs in them, beginning at the centre of the cells, where giant-cells are first formed, proceeding to coagulation-necrosis and caseation. A number of these granulations united form the small, yellowish masses, which may be seen by the unaided eye. Caseation is due to vascular obliteration.

The small, yellowish masses, softened at their centres, are surrounded by fibrous tissue due to sclerosis of the stroma of the gland. When this tissue gives way, several masses form a large collection of yellowish, softened material resembling putty. Calcification may occur when the process is very slow.

The specific lymphadenitis blocks the lymph-spaces and thus, for a time at least, mechanically prevents the bacilli from penetrating into the general circulation. Glands not in the stream become infected, this probably being due to the transportation by migrating cells of the motionless bacillus. However, infection usually takes place in the direction of the lymph-current. As the lymph-spaces are obstructed by inflammation products, and entrance of fresh bacilli into the gland is thus prevented, it is the multiplication of those already entered into the gland which gives rise to the tuberculosis. When caseation occurs, nearly all the bacilli have disappeared, but the spores remain, and are capable of reproducing the disease. Suppuration is due to a secondary infection by pyogenic micro-organisms. (Senn.)

The virus of tubercular adenitis is less potent, for the caseous material of a lymph-gland kills guinea-pigs, while rabbits escape, the latter being less susceptible to tuberculous infection.

Taken as a whole, tuberculous adenitis (*a*) is a local disease which may frequently undergo (*b*) spontaneous resolution, but which (*c*) frequently tends to suppuration, the pus being nearly always sterile. It is, however, a constant danger to the system.

Chronic adenitis may, in some cases, be due to continued irritation; ulcers; chronic lesions of the skin or mucous membrane of the bones; periosteum; articulations; chronic inflammation of the viscera; and certain new growths where the adenitis is purely irritative and not yet specific.

Researches on the relation existing between caries of the teeth and simple chronic and tuberculous adenitis in children. In 41 per cent. of the children examined no etiological factor for cervical adenitis found except concomitant dental caries. Caries of the teeth to be looked upon as relatively the most important cause of cervical adenitis in children. H. Stark (Beit. z. klin. Chir., vol. xvi, No. 1, p. 61, '96).

Prognosis. — A chronic adenitis may end in resolution, suppuration—caseation (see PATHOLOGY), cretaceous formation, or cyst-formation. If all the tuberculous matter can be eliminated, either by nature or art, a recovery may be obtained. The deeper glands are more dangerous than the superficial, as they are extirpated with more difficulty. The great danger of local tuberculous adenitis is that it may give rise to other tuberculous lesions, either *local* (pulmonary phthisis, tuberculous osteitis, white swellings, or abscesses) or *general* (generalized tuberculosis, with rapid death).

Acute miliary tuberculosis may be caused in two ways: either by conveyance through the lymphatic system until the venous system is reached or by the perforation of a vein and the entrance of tuberculous material. (Weigert.)

Treatment. — The general treatment should receive considerable attention. Good food, country air, and sea-bathing are of the greatest value.

In peribronchial adenitis the same general methods are to be resorted to. When due to tuberculosis and kindred diatheses and uncomplicated by fever or involvement of lung-tissue, the sea-shore or the country is indicated. At the seaside children should not bathe in the sea, and should be as quiet as is consistent with life in the open air. Brisk frictions, milk, a nutritious diet, and iodotannic syrup (2 to 4 teaspoonfuls per day) are effectual measures. After three to four weeks, emulsion of calcium lactophosphate and codliver-oil should be given. Counter-irritation between the shoulder-blades favors the curative action of the other remedies (Marfan). Applications of tincture of iodine between the shoulders, or in some cases blisters or, even better, ignipuncture, will fulfill the latter indications. Iron-iodide syrup, iodotannic syrup, iodine tincture, potassium iodide, or large doses of codliver-oil, either alone or with cinchona-wine, arsenic, or arseniate of sodium are the standard remedies usually recommended in these conditions. Not much is to be expected from them, however, unless outdoor life is insisted upon.

Every case of cervical adenitis coming under observation tested. Tuberculin used was 1-per-cent. solution of Koch's original product. If in from six to twenty-four hours after injection there occurred weakness, sensations of heat and cold, general malaise, nausea, anorexia, severe headache, pain in back and limbs, and if these symptoms were sharply defined in both their beginning and ending, reaction was considered to have occurred. All cases were practically without fever at time of injections. No bad results followed. In only one case was reaction excessive. It generally occurred in from 8 to 14 hours after injection and continued from 12 to 36 hours. From 1 to 5 milligrammes constituted usual dose. On 29 cases there were positive reactions in 18 and doubtful in 2. In 6 of 11 cases in which there was no reaction glands had been enlarged only for from 1 to 3 weeks. In majority of positive cases they had existed for six months or more. Of the 29 patients studied, 22 were females. In 17 patients diseased glands were on left side. General and local treatment advised in positive cases, local treatment consisting in excision of glands when possible, or free incision and drainage when suppuration has taken place. Ed-

ward O. Otis (Phila. Med. Jour., July 16, '98).

Extirpation is recommended, but the possibility of giving rise to a tuberculous process elsewhere by facilitating absorption through exposed tissues should be borne in mind.

Many cases of cervical adenitis are met with in which the avoidance of minimizing of scar is of great importance, and in which radical operative measures are not demanded. In such cases aspiration, or the use of a seton, or both, while not infallible, may prove successful. While such measures might be successful in cases of tuberculous glands, they are attended with possible dangers, and when the tuberculous glands do not subside under medical treatment, excision, done with extreme care and reasonably early, is the method of choice. Neither aspiration nor the use of a seton should be resorted to in cases involving the deep cervical glands. F. S. Bulkeley (Amer. Med., Feb. 27, 1904).

Senn states that early operative interference is as necessary in the treatment of tubercular adenitis as in the treatment of malignant tumors, and holds out more encouragement, so far as a permanent cure is concerned. Tillmann argues that glandular tuberculosis should be operated as soon as possible, in order to prevent general miliary tuberculosis by the passage of the bacilli into the system.

Immediate excision of infected glands in tubercular inguinal adenitis advised. Brault (Lyon Médical, No. 10, '94).

1. Whenever fluid—that is, pus—can be detected in connection with a diseased lymphatic gland, the operation should be done before the skin becomes red and thin. 2. When the diseased gland is subcutaneous—that is, not beneath the deep fascia or muscle, and has been completely removed—the least scar will result if neither stitches nor drainage-tube be used, especially if it be possible to leave the wound uncovered by dressing and exposed to the air, so that the edges may be drawn and glued together by drying lymph. 3. If the diseased gland be beneath the muscle or muscular fascia, then a drainage-tube must be used and the edges of the wound must be united by suture. The best drainage-tube is the gilt spiral wire, especially as it may have to remain from two to eight or ten weeks, according to the depth of the wound or the completeness of the removal of the gland. 4. Where many glands have to be removed, it is better to remove them through a series of small incisions and thereby avoid very extensive ones. Considering the subject from a pathological point of view, all sinuses and suppurating cavities should be thoroughly cleansed by means of scraper and lint, so as to leave a fresh surface free from granulation or decayed or decaying tissue, and a drainage-exit should be maintained until all the deep parts are healed. Teale (Brit. Med. Jour., No. 1717, '93).

Extirpation is indicated when internal medication has failed; when glands involve the face and produce deformity; when they are isolated and not numerous; when they have undergone fibrous degeneration; when they are not freely suppurating. It is contra-indicated when there is impaired general health and tubercular deposits in the lungs and joints; when ramifications of glandular chain are very extensive. Le Dentu (Revue Int. de Méd. et de Chir., Sept. 10, '95).

[To be of real value extirpation must be done before infection has extended beyond the glands involved, else the infection will proceed, nevertheless, to generalization. When done later, it may prevent that secondary infection which follows from an overswollen or suppurating gland, and may be of cosmetic value; that is, to prevent unsightly and extensive scars. C. SUMNER WITHERSTINE, Assoc. Ed., Annual, '96.]

Sternal adenitis falls into three groups due to the anatomical position, whose principal symptoms are as follow: 1. Deep adenitis; phenomena of constriction; extension to the mediastinum and the axilla. 2. Medium adenitis; no phe-

nomena of constriction; position, substernal; deep cicatrix, retrosternal. 3. Superficial adenitis; position, presternal. Maurice Patel (Gaz. Hebdom., Sept. 16, 1900).

Tuberculous adenitis of the cervical region is almost always local, and takes place through the buccal cavity. A suppurating gland is always dangerous, and should be removed entirely. Small groups or single, slowly growing glands are likewise to be removed. Nature will provide a new and equally perfect protection against external invasion, to take the place of the glands that are lost by operative procedures. H. Horace Grant (N. Y. Med. Jour., Oct. 20, 1900).

Sigmoid incision for the removal of cervical glands. (*Senn.*)

After incision, thorough curetting followed by iodoformization and closure should be performed. The wound should be drained. The operator should not only feel, but see, every gland he removes. In cervical adenitis an S-shaped incision gives more room and a better cicatrix. (Senn.)

In other regions the incision should be made so as to bring its axis parallel with the cutaneous folds. Local recurrence should be treated in the same way. Three or four operations in as many years have been performed by Senn on the same patient, with final successful result.

One thousand cases of extirpation of tuberculous glands, without a single case of pyæmia or septicæmia and only two cases of erysipelas, in both of which the infection was traced to a nurse. One of the best criterions of the success is the ever-increasing number of patients who present themselves for operation, and who nearly all enter the hospital asking for the removal of their enlarged glands. Milton (St. Thomas's Hospital Reports, vol. viii).

Out of 335 children treated, the tuberculous glands were removed in 102. The operated cases gave a percentage of 83.34 cured, and the non-operated 68.77 per cent.; that is, 14.56 per cent. in favor of the operation. Generalization of the disease could be found only in 1 per cent. of the cases. Cazin (Lyon Méd., Jan. 11, '90).

Five hundred and six cases: 286 operated; 220 medically treated. Of the operated cases 149 were carefully followed during three years; 93 (62.4 per cent.) have not shown the least sign of return of the affection. In the remaining 56 cases there was a return. Of the 149 non-operated cases, 28 died in sixteen years (18 per cent.) from general tuberculosis, and 14 are still alive, but have developed pulmonary tuberculosis. Von Noorden (Schmidt's Jährbücher, July, '90).

When many glands are involved and suppuration has occurred, or when periadenitis is present, excision is not to be recommended, as extensive connective-tissue infiltration renders it impossible to remove all the infected tissue. Subcutaneous extirpation may be resorted to, but the method allows of but imperfect evacuation of the glandular contents and can hardly be recommended.

Subcutaneous extirpation. Incision at the nape of neck, beginning on a level with the external auditory meatus, 1 centimetre from hairy border, and passing with a slight convexity downward 5 centimetres backward, downward toward the median line. Dollinger (Cent. f. Chir., No. 36, '94).

Drainage of the abscess is a measure which may be recommended for many reasons. A small incision is sufficient for all purposes, and there is practically no scar left.

> Observations upon 170 cases of tuberculous cervical adenitis show the disease to be more prevalent among negroes than among whites, males preponderating over females in the proportion of 3 to 2, the majority being between 10 and 30 years of age. A family history of tuberculosis was present in about half the cases, though only 4 per cent. showed positive evidence of the disease in the lungs. The condition is regarded as a local manifestation of infection through the tonsil, adenoids, or carious teeth, and the tuberculin test in diagnosis was found to be reliable and harmless. After discussing the constitutional, local, and conservative operative treatment by curetting, partial excision, and application of iodoform, the radical operation for removal of all the glands and surrounding fat is described as follows: By a T-shaped incision, the long arm of which curving forward over the sterno-mastoid muscle and starting from the mastoid process joins the short arm along the clavicle, the dissection is carried from below upward and outward from the middle line, the external jugular vein being tied and divided. The omohyoid muscle is then divided, and by using it as a retractor the internal jugular vein is exposed and the sterno-mastoid muscle pulled aside. In dissecting out the mass of glands the greatest difficulty is experienced with the chain connecting the anterior and posterior triangles behind the sterno-mastoid muscle, as the spinal accessory nerve passes through the mass and is generally very adherent. It is only when there is very extensive mischief that it becomes necessary to divide the sterno-mastoid muscle or spinal accessory nerve, or even to tie and divide the internal jugular vein, and these steps should only be resorted to when the advantages of free exposure outweigh other considerations. The wound is closed with a subcutaneous silver suture and drained at its most dependent part and the resulting scar is usually slight. Mitchell (Bull. Johns Hopkins Hosp., July, 1902).

Less radical measures sometimes bring about a cure. A transformation of the tuberculous tissues into a sclerotic mass may be obtained. A solution of chloride of zinc injected about the tuberculous foci excites a growth of new fibrous tissue, which encapsulates the diseased portion.

> Twenty-three patients suffering with joint and gland tuberculosis treated in this manner. Fibrous-tissue formation occurred in every case. Injections made of 2 to 5 drops of a 10-per-cent. solution of the zinc chloride, and often repeated. Lannelongue (Le Bull. Méd., July 8, '91).

Solutions of iodoform and ether, after Verneuil, in cases where operative procedures are indicated, give a lasting cure, without a cicatrix. These injections seem to exert a beneficial action, not only on the tuberculous glands treated, but also on those at a distance from the seat of the injection.

> Impure glycerin always contains a certain amount of formic acid. In the treatment of tuberculosis by the iodoform-glycerin injections the irritating properties of the formic acid may have some share in the curative effects of iodoform emulsions. Iodoform itself in the body is converted by oxidation into formic acid and hydriodic acid. When oxidation is sufficiently active to decompose it, iodoform is more effective than when oxidation is feeble. Hence formic acid added to iodoform emulsions should be effective. Favorable results where iodoform has proved ineffective. In cases of tuberculous adenitis and in one case of tuberculous arthritis of the ankle-joint formic acid used alone, the formate of soda in solution being injected. Excellent results obtained. Senger (Deutsche med. Woch., No. 17, '91).

Camphor-naphthol has proved valuable in some cases.

It is claimed in favor of camphor-naphthol that there is no danger of

intoxication and that the treatment is almost painless. Ménard and Calot, however, have reported cases of intoxication following injection of camphor-naphthol into abscess-cavities. The patient suffered from frequent rapid pulse, loss of consciousness, and epileptiform attacks. The quantity of the drug injected was about 6 drachms. This patient recovered. In another case, 8 years of age, $1\frac{1}{2}$ ounces of the solution were injected. In the third case, aged 12, 5 drachms. In the last two cases life was saved by freely opening the cavity and washing it out on the first appearance of toxic symptoms.

Camphorated naphthol is prepared and used as follows:—

℞ Betanaphthol,
Camphor, of each, 10 parts.
Alcohol (60 per cent.), 40 parts.

A few drops are to be antiseptically injected here and there throughout the mass of indurated glands. Courtin (Jour. de Méd. de Bordeaux, May 17, '91).

Of 47 cases 28 were cured and 19 improved. Reboul (Marseille-médical, Jan. 30, '91).

Camphorated naphthol recommended (1) for dressings, (2) in cases of recurrence after excision, (3) in cutaneous gummata of the face, and (4) in subjects with an inoperable tuberculous mass. In the last cases the injections gave a result not obtainable by any other method. Moty (La France Méd., July 9, '93).

Solution of lactic acid recommended as a parenchymatous injection, beginning with weak solutions of not more than 15- or 20-per-cent. strength, and gradually increasing to 35- or 40-per-cent. strength. A 15-per-cent. solution of the lactic acid alone generally causes considerable suffering, but when combined with from 2 to 5 per cent. of carbolic acid it causes but little pain. Twenty or 30 minims of the solution injected, then withdrawn after a few minutes, repeating in a week or two. E. F. Ingals (Inter. Med. Mag., June, '96).

Interstitial injections, frequently recommended, usually fail or cause suppuration, owing to the fact that the tincture of iodine is employed. Metallic iodine, however, gives a better result.

Metallic iodine has a special affinity for tuberculous glands. Eight or ten applications usually insure cure, provided the cavity is filled with crystals. Guermonprez (Gaz. des Hôp., June 25, '95).

C. Sumner Witherstine,
Philadelphia.

ADENOID VEGETATIONS. See Naso-pharynx.

ADENOMA. See Tumors.

ADIPOSIS. See Fatty Heart and Obesity.

ADONIS.—Adonis is a ranunculaceous plant, closely related to the anemone, growing wild in Europe, Asia, and Africa. Several species of adonis are employed,—*Adonis vernalis, A. æstivalis, A. capeusis, A. cupaniana,* and *A. amurensis,*—but all seem to possess the same properties, although the several varieties are variously employed in the different countries in which they grow. In Russia, for instance, it has long been employed in cardiac diseases, and in Africa as a substitute for cantharides, the bruised leaves, when fresh, possessing vesicating properties.

Dose.—An infusion of 4 to 8 parts of the plant in 200 of water may be given in tablespoonful doses three or four times a day (Huchard). The tincture may be administered in doses of $\frac{1}{2}$ to 1 drachm. Adonidin, a glucoside of adonis, is administered in doses varying from $\frac{1}{20}$ to $\frac{1}{10}$ grain. It acts more promptly than digitalis. (H. C. Wood.)

Physiological Action.—Adonis resembles digitalis in its action upon the heart.

It increases the cardiac energy and gives rise secondarily to an increase of arterial tension. The increased contractions eventually diminish and a period of quiet follows, varying in duration with the dose administered.

Cervello isolated a glucoside from *Adonis vernalis*,—adonidin,—a yellow powder having a bitter taste, obtained from the leaves. It is soluble in water and alcohol, but insoluble in ether or chloroform.

Inoko also obtained a glucoside—adonin — from the Japanese plant, *Adonis amurensis*. This substance is free from nitrogen, amorphous, colorless, of a bitter taste, and soluble in water, alcohol, and chloroform. The symptoms observed on the heart of a frog were precisely those seen when digitaline is used. It is about twenty times weaker than the adonidin obtained from the European *Adonis vernalis*.

Adonis Poisoning.—In poisonous doses adonis paralyzes the peripheral extremities of the vagus, tends to excite the accelerator system, and it finally produces paralysis of the cardiomotor nerves.

Therapeutics. — Adonis is useful in cases of uncompensated heart affection in which grave circulatory disorders exist. The marked diuretic powers of the drug cause it to be of value in cases of dropsy and fatty heart. It is also valuable in palpitation dependent upon irregular inhibition and in aortic and mitral regurgitation (Oliver, Wood). As it does not seem to possess cumulative tendencies, it may be administered with more freedom.

> Adonis vernalis used in thirty-three cases. It will sometimes succeed where digitalis has completely failed, but it is often not given in sufficiently large dose. Case illustrative of the tolerance of large doses of the infusion. Boy-Teissier (Marseille-médical, Mar. 30, '88).

> Adonis employed in a large number of cases of different cardiac disorders. One drachm to one ounce of the infusion daily constitutes an excellent cardiac tonic. In fatty degeneration of the heart it increases diuresis and regulates the circulation. In many cases of heart disease the drug is effective when digitalis is useless or injurious. F. Borgiotti (Deutsche med.-Zeit., Aug. 30, '88).

Obesity.—As a remedy for the reduction of superfluous adipose tissue, adonis æstivalis has proved of value. Owing to the fact that it does not possess a tendency to cumulation, it may be continued for a long time.

> Case in which the patient weighed 342 pounds and suffered severely from dyspnœa when the administration of adonis was begun. After taking 10 drops of the tincture three times daily for twelve days there was a loss in weight of 17 pounds, the respiration had become easier, and there was general euphoria R. Kessler (Amer. Medico-Surg. Bull., Aug. 15, '94).

Epilepsy.—To reduce the active cerebral hyperæmia present during a paroxysm, adonis has been recommended, owing to its power of stimulating the vasoconstrictors. It may be advantageously combined with the bromides.

> Several years of the use of adonis vernalis have shown its ability to cause almost immediate cessation of the fits in some cases. Bechterew (Neurol. Centralb., Dec. 1, '94).

AGALACTIA. — From α, priv., and $\gamma\alpha\lambda\alpha$, milk.

Definition.—Absence of the mammary secretion after parturition. The term is generally understood as meaning defective lactation, especially as to quantity.

Symptoms.—Absence of the mammary secretion after labor is rarely observed. The appearance of milk may be delayed days and even weeks, but evidence of functional activity usually appears, although frequently the quantity secreted

is insufficient or the quality of the milk is not of a character to afford sufficient or proper nourishment to the infant.

> Statistics of 126 lying-in women in the obstetrical wards of the Halle clinic from February to May, 1895, inclusive. Out of the 126 cases, 83 (or 65.9 per cent.) had sufficient milk when discharged between the tenth and twelfth days. Buchmann (Centralb. f. Gynäk., No. 25, '96).

Deficiency of secretion may occur from the start and continue throughout the entire period of lactation, or it may be normal in amount at first and gradually diminish.

Etiology. — Heredity is a prominent factor in case of true agalactia. Puech has reported the case of a woman who had given birth to thirteen children, but whose breasts, though normal, had never yielded milk. Her mother, who had given birth to twenty-three children, had likewise been absolutely sterile as regards the secretion of milk.

> Case of complete agalactia in a woman, aged 25, primipara, whose mother is living and in good health, having borne 9 children, 3 of whom are now living; 4 died at about five years of age, 1 at eight, and 1 at twelve months. The patient is the eighth child, and says her mother has often told her that in none of these puerperia had she any milk, although the breasts were natural in appearance. The patient has one married sister, who at 25 years gave birth to a full-term child, and she never had a drop of milk for her baby. J. Ives Edgerton (Med. News, Feb. 6, '97).

General ill health in which anæmia plays the leading rôle is the most frequent cause of retarded, defective, or imperfect lactation. Lack of confidence, on the part of the mother, of her ability to nurse; excitement, fatigue, highly spiced food, overfeeding, and insufficient sleep may be mentioned as the most frequent auxiliary factors.

Injudicious dressing whereby the mammæ are compressed, the pressure interfering with their circulation and proper nutrition, is a frequent cause of deficient lactation. Advanced age, especially in women who have suffered frequently from miscarriages, may also be included among the etiological factors. The habit of weaning early or avoiding lactation tends to cause atrophy of the breasts and to repress the lacteal secretion.

Prolonged suckling, specific affections, and iodide of potassium are also considered as causes of mammary atrophy, and, therefore, of deficient lactation powers.

Intercurrent affections, especially when acute, frequently arrest the flow of milk. High fever, when temporary, usually causes diminution of the secretion for the time being, and it may act as the primary factor of gradual cessation.

Pathology. — When there is total absence of mammary secretion, both breasts are usually affected. When the secretion is only defective, the involvement of the glands in the pathogenic process, local or general, is usually unequal, one mamma being less productive than the other. Large breasts, owing to the quantity of adipose tissue present, are more likely to be agalactic than the smaller and thinner ones. The ducts and glands are usually found deficient in number and size, while the adipose tissue or the fibrous stroma is unduly abundant.

Treatment.—The first indication is to carefully inquire into the cause of the condition. In the majority of cases there is general deficiency in the performance of metabolic processes due to general physical apathy. The patient should, therefore, be provided with nutritious food and appropriate tonics, especially strychnine, which is peculiarly effective in these cases.

The bowels should be regulated by proper dieting and massage or exercise rather than by laxatives, and it is highly desirable that there should be at night uninterrupted sleep for six hours for mother and child.

Galactagogues are valueless in the majority of cases, most of them exerting practically no influence upon the gland. Occasionally a slight stimulating effect may be noted, but this lasts only a short time, and the organ soon lapses into its former torpor.

Beer, ale, porter, and other malt liquors, especially alcoholic beverages, are more hurtful than beneficial, and what improvement may show itself is due mainly to the confidence in the beverage taken, through the agency of auto-suggestion. The quantity of milk may be increased, but its quality is compromised, especially when poor beer is consumed by the mother. It encourages the production of fat at the expense of the casein or milk-sugar. Pure malt may be substituted with great advantage.

> It is an error to suppose that stout or porter improves milk. Another error is the belief that beef-tea and chicken-broth are good for nursing mothers. Angel Money (Austral. Med. Gaz., Jan. 20, '97).

> Somatose exercises a specific effect upon the mammary glands of nursing mothers; it produces an ample secretion of the mother's milk, and causes the ailments occurring during nursing to disappear quickly. The dose consists of 1 teaspoonful in a cup of warm milk, soup, cocoa, etc., from three to four times a day. Felix Heymann (Deut. med.-Zeit., Nos. 59, 63, '98).

Probably the most satisfactory among the galactagogues is jaborandi. The fluid extract or the tincture may be given in $^1/_2$-drachm doses. The active perspiration and salivation produced are objectionable, however, while the effects of the remedy are not lasting.

> Case where the administration of 10 drops of the fluid extract of jaborandi every four hours to a patient whose milk had ceased for a fortnight effected a re-establishment of the secretion. The patient, however, soon began to suffer from extreme nervous excitement with delusions. On stopping the jaborandi the nervous and mental symptoms disappeared and also the secretion of milk. Waugh (Lancet, Dec. 24, '87).

Castor-oil leaves have always borne considerable reputation. A decoction is made by boiling well a handful of them in 3 to 4 quarts of pure water. The breasts are bathed with this decoction for fifteen to twenty minutes. Part of the boiled leaves is then thinly spread over the breast and allowed to remain until all moisture has been removed from them by evaporation, and probably, in some measure, by absorption. The procedure is repeated at short intervals until the milk flows upon suction by the child, which it usually does in the course of a few hours. (Routh.)

Galega is credited with galactagogue properties, $^1/_2$ to 1 drachm of the dried leaves being administered daily.

Electricity sometimes proves effective. A mild current (3 to 5 milliampères) is passed through each breast after carefully wetting the sponges in salt-water and applying them on each side of the gland. By changing the position of the electrodes, every minute or so, to a neighboring spot, all the acini may be traversed by the current during a sitting of ten minutes. The applications should be made every two or three hours. A strong current is more hurtful than beneficial. Artificial suction with the breast-pump and massage are greatly used. The extract of thyroid gland has recently given very satisfactory results.

> Nine cases showing the value of thyroid-gland extract as a galactagogue, the object being to increase the activity of

the metabolic processes. In one of the cases the administration of four tabloids was sufficient to restore the lacteal secretion, which continued as long as the tabloids were regularly taken. Neglect of the tabloid caused the milk to fail. In six cases the milk-supply returned in three days and became plentiful. In two, no influence on the milk observed, the patients being delicate, nervous, and worn out. R. R. Stawell (Intercolonial Med. Jour., Apr. 20, '97).

As to the diet, it should be as generous as the patient can digest. There is little to be gained by the common practice of prescribing two or three extra meals a day. The milk-supply as well as the general health of the woman will depend more upon what she digests and assimilates than upon the amount of food taken into the stomach. Three daily meals with, at most, a single liquid meal at bed-time, will generally be better than five or six. Milk should constitute a portion of the dietary. The difficulty in digesting milk, of which many patients complain, is, for the most part, imaginary. If taken as a part of the meal and not in addition to it, it will, as a rule, be well borne. Frequently patients who cannot use cold milk can take it hot without difficulty.

The secretion of milk is said to be greatly diminished by fatty food. A vegetable diet reduces the proportion of butter and casein and diminishes the sugar. A meat diet has the opposite effect. Systematic nursing with strict observance of stated intervals is essential for its influence upon both the quantity and quality of the milk-secretion. (Charles Jewett.)

C. Sumner Witherstine,

Philadelphia.

AGARICIN. — Agaricin is obtained from white agaric. It is a white, crystalline powder, soluble in alcohol, and but slightly so in cold water and ether. Agaricic acid, the pure active principle of agaricin, is generally used.

Dose.—The dose of agaricic acid is $^1/_6$ to $^1/_2$ grain, administered in pills. Hypodermically its effects are more active and the dose should be one-half smaller.

Physiological Action.—The physiological effects of this drug are not known, but they are supposed to resemble those of pilocarpine, or to act mainly upon the nervous supply of the sweat-glands.

Agaricin checks pathological sweating, not by a central action, but by directly influencing the glands themselves. In this only does it resemble atropine. Small doses, $^1/_8$ to $^1/_2$ grain, preferred to a single large dose. The action is slow, but lasts a long while. Hofmeister (Archiv f. Exp. Path. und Pharm., vol. xxv, '89).

Therapeutics. — Agaricin is especially valuable in the treatment of the night-sweats of phthisis. If the gastric digestion is good, it will be well tolerated and produce its effects in from two to six hours. Administered before retiring, it sometimes acts as a preventive of the exhausting perspiration attending advanced cases. It is not effective in all cases, however. (Hare, Butler.)

Sweat is always decreased, thirst and the excretion of the urine are diminished, the functions of the lungs and skin are not interfered with, and there are no bad effects. The administration of pure agaricic acid greatly lessens the danger of vomiting and purging. The subcutaneous injection of the soluble sodium salts should not be used, as violent inflammation may follow. W. T. Thackeray (Chicago Med. Jour. and Examiner, June, '89).

Seventeen cases in which agaricin was found to possess most excellent antisudorific properties, the effect being pronounced not only in tuberculosis, but in other forms of poisoning and infection. This agent, even in the third stage of pulmonary tuberculosis, was able to

suppress the distressing night-sweats, its action being manifested in from two to six hours after the ingestion of the drug and lasting about six hours. No evil after-effects of any kind were observed. The dose employed was from $^1/_8$ to $^1/_4$ grain in pill form. Combemale (Bull. Gén. de Thér., May 30, '91).

Agaricin most successful of all drugs in combating night-sweats in phthisis. Its active principle, agaricic acid, may be used in $^1/_4$- to 1-grain doses. Method of administering which has given most excellent results is as follows: Give $^1/_8$ grain at first dose and follow with $^1/_8$ grain every four hours until the sweating is checked, then continuing its use—but lengthening the interval—until the smallest quantity necessary to control sweating is reached. Rufus D. Boss (Amer. Therap., Mar., '98).

Minute doses are sometimes as effective as the larger ones, and had better be tried before resorting to the full doses.

Agaricin in pill form, in doses of $^1/_{12}$ grain at bed-time, or given late in the afternoon and repeated in four or five hours, was the most successful of all the drugs used in the night-sweats of pulmonary tuberculosis. Conkling (Brooklyn Med. Jour., July, '94).

AGRAPHIA. See APHASIA.

AINHUM. — African word meaning "to saw off."

Definition. — Ainhum is a disease occurring exclusively in negroes and consisting in the spontaneous amputation of the little toe by an adventitious fibrous band.

Symptoms.—The first indication of the disease is a furrow on the lower surface of the little toe, and occasionally other toes, at the proximal interphalangeal joint. This furrow, the result of the circumferential pressure exerted by a fibrous ring, gradually deepens until the bone is reached, this process taking several years, sometimes as many as ten. The distal portion of the toe becomes greatly hypertrophied, then finally drops off, the stump healing without further complication in the great majority of cases. It does not give rise to much suffering, owing to its very gradual progress. It is sometimes mistaken for leprosy.

Ainhum is an affection apart from leprosy. Cases of circular constriction in leprosy are exceedingly uncommon, are always located on the fingers, and are always accompanied by other morbid manifestations, which indicate a more or less intense infection of the blood by the virus or a localization of the affection in the nerves, the skin, or the mucous membrane. H. de Brun (Bull. de l'Acad. de Méd., Aug. 25, '96).

Etiology.—Ainhum is always observed in negroes, especially of the western coasts of Africa and South America. A number of cases have also been reported in the United States by Bringier. Hindoos are said to also suffer from this disease. Self-mutilation has been suggested by some observers, but the likelihood of this cause is very slight. Heredity does not seem to play any rôle in its production.

Pathology. — The lesions observed have been hypertrophic thickening and retraction of the derma, with consequent atrophy of the underlying bone (Hermann, Weber, Wucherer, Schüppel). It has been confounded with congenital amputation, but, as stated, ainhum is never congenital. That the disease bears some connection with leprosy is insisted upon by some authorities.

In all cases of true ainhum undoubted symptoms of leprosy are present. It should be looked upon as an attenuated form of the latter disease. Its relations to scleroderma are explained by the fact that this latter affection is a special form of leprosy. Zambaco Pacha (Bull. de l'Acad. de Méd., July 28, '96).

Treatment. — Surgical measures alone prove of value in these cases. Early

section of the fibrous ring is sometimes sufficient to arrest the progress of the disease or division of the skin down to the periosteum on the opposite of the seat of disease may be resorted to.

> Case successfully treated by dividing the skin and all the tissues down to the periosteum, on the side opposite to the seat of the disease. Murray (Lancet, Jan. 30, '92).

AIROL.—Airol is a compound of dermatol and iodine discovered and introduced by Lüdy as a substitute for iodoform. It occurs as a tasteless and odorless powder, unaffected by light, and containing 44.5 per cent. Bi_2O_3 and 24.8 per cent. of iodine; its color is gray-green, but moist air or the discharge from a wound rapidly converts it into a red substance, with liberation of iodine. It is insoluble in ordinary reagents, but readily dissolves in strong caustic soda or weak mineral acids.

Preparations and Dose.—The powder is employed in the same manner as iodoform in the treatment of superficial lesions.

It has also been used dissolved in glycerin, but Aemmer has recently shown that the poisonous effects of the drug were thus increased.

Bruns, of Tübingen, recommends airol paste as an ideal dressing for sutured wounds. It dries rapidly and adheres closely; it is powerfully antiseptic, and absolutely unirritating to the most sensitive skin; but its chief advantage is that it permits the secretions to ooze through it. He has used it for six months, especially after laparotomies, herniotomies, and ignipunctures, and did not observe an instance of stitch-hole suppuration with it. He concludes that occlusion with airol paste furnishes the simplest means of obtaining healing by first intention. His formula is: Airol, mucilaginous gum arabic, glycerin, of each, 10 parts; bolus albus, 20 parts. He employs it even in wounds with drainage.

Airol Poisoning. — The untoward effects of airol were recently shown in a case treated by Aemmer: after using injections of iodoform-oil without benefit in an abscess resulting from hip disease, this surgeon evacuated the pus and injected 9 drachms of a 10-per-cent. emulsion of airol in equal parts of olive-oil and glycerin. The immediate effects were acute local pain, headache, and coryza; but three days afterward symptoms of bismuth poisoning supervened: fœtid breath, blackish line on the gums; swelling, tenderness, and ulceration of the lips, gums, and pharynx interfering with mastication and deglutition; headache, anorexia, nausea, and prostration. To relieve these symptoms, which were becoming more serious, it was necessary to open the abscess and remove the emulsion of airol. The patient rapidly grew better, but a slate-colored pigmentation of the buccal mucous membrane persisted for a month. Aemmer has found that a certain quantity of airol is dissolved by glycerin, and that intoxication is, no doubt, favored thereby. It is, therefore, better not to use glycerin in combination with airol. Goldfarb has also drawn attention to the fact that applications of airol are sometimes very badly tolerated. Zelenski found that its use on a burn was followed by intense pain and the formation of large bullæ containing yellow fluid, and that a suppository containing 3 grains of airol introduced into an anal fistula caused suffering comparable to the red-hot iron.

Therapeutics. — The delay in the growth of organisms produced by airol is slightly greater than that resulting from iodoform, and infinitely more than

the effect of dermatol. It is found that the influence of antiseptic powders is greater the earlier their use is commenced; in acute phlegmonous processes, however, they do but little good, while, the more chronic the inflammation, the better the results obtained, whence their special indication in tuberculosis. The two great advantages in this respect which airol has over iodoform are: first, the fact that a small quantity of its iodine is liberated as soon as it comes in contact with the tissues, and, secondly, that the presence of bismuth exercises a powerful desiccating influence upon the secretion, thereby greatly aiding antisepsis.

Two thousand cases treated with airol not one of which showed sign of bismuth poisoning. Airol gauze (20 per cent.) also employed as a dry dressing. Its value is particularly striking in superficial lesions, such as ulcers and burns. In tuberculous abscesses the form employed is a 10-per-cent. emulsion in equal parts of glycerin and water. It is extremely bulky, being four times as light as iodoform, and twice as light as dermatol. Haegler (Brit. Med. Jour., Apr. 24, '97).

In treating wounds the paste is perfectly unirritating and non-toxic, dries rapidly, and adheres firmly, and possesses hygroscopic and antiseptic qualities which render it superior to any other preparation. The paste is equally adapted to all parts of the body, and the dressings cannot become loose or movable. V. Bruns gives the following formula:—

℞ Airol, 1 drachm.
Mucilage, 2 drachms.
Glycerin, 2 drachms.
Argilla alba (kaolin), sufficient to make a soft paste.

If the paste becomes too dry, glycerin may be added; if it be too soft, kaolin should be rubbed up with it. No metal instruments should be employed in preparing the paste, since many metals liberate iodine from airol. For the same reason no water, but always glycerin, is to be used in the preparation. The paste is preserved in well-stoppered glass or porcelain jars, which are not to be left open after use. Honsell (Deut. med. Woch., xxvii, No. 17, 1901).

Disorders of the Skin. — It is in this class of affections that airol is most effective. In ulcers, eczema, and intertrigo its beneficial influence has been conspicuous. Leprosy has recently been added to the list. One case, however, is hardly sufficient to warrant much confidence.

Remarkable improvement in a case of typical leprosy of five years' standing, consequent on the use of airol dusted on the ulcers and open abscesses, together with a 10-per-cent. vaselin ointment applied to the conjunctivæ and injected into localities where softening had commenced. Tonics were also prescribed and general massage practiced. The drug was well borne, but the gums became discolored by the bismuth in the airol, and when very large doses were given a certain degree of prostration was observed. Fornara (Lancet, July 3, '97).

Diarrhœa.—Airol has recently been tried by Italian physicians in the treatment of diarrhœa, the alterative properties of iodine and the antiseptic action of bismuth having suggested its employment. The effects seem to have been satisfactory.

In 9 instances of pellagrous intestinal disease, airol, in 5- to 8-grain doses, frequently repeated, gave excellent results. Not only its astringent properties should be mentioned, but its iodine content appears to be responsible for the greater part of its good effects. F. Cerato (Gaz. degli Osped. e. delle Clin., No. 142, p. 1502, '98).

Suppurative Processes.—In conditions accompanied by the destruction of tissue by suppuration—boils, carbuncles,

etc.—airol seems to be entitled to recognition as a valuable remedy.

GONORRHŒA. — The known value of bismuth in the treatment of catarrhal disorders of mucous membranes due to local infection and the alterative effect of iodine tend to support the claims of airol as an effective remedy for gonorrhœa.

Four cases of gonorrhœa completely cured after three to five injections of an airol solution. The anterior urethra is first washed with a boric-acid solution. Two and one-half drachms of the following solution are then injected:—

℞ Airol, 30 grains.
Glycerin, ½ ounce.
Water, 75 minims.

This procedure is repeated four or five days in succession. Legueu and Levy (Revue de Thér., May 15, '96).

Special attention called to the value of a 10-per-cent. emulsion of airol in glycerin as injection in gonorrhœa. Used in three cases of acute and three of chronic gonorrhœa, all of which have recovered in ten to fourteen days after three to ten injections, never repeated more often than once daily. No toxic effects were observed. Tausig (Wiener med. Presse, Oct. 11, '96).

ALBUMINURIA. — From Lat., *albumin*; and Gr., *ουρειν*, to pass the urine.

Definition.—The presence of albumin in the urine. Albuminuria may be *true* —when the albumin is dissolved in the urine—or *spurious*, when caused by admixture of semen, pus, or blood in the urine. Spurious albuminuria is easily distinguished from the true form by the aid of the microscope. Both kinds of albuminuria may occur simultaneously.

Domenico Botugno discovered, in 1770, that urine may contain albumin; by boiling a sample of urine he found that pure albumin was precipitated. It was long maintained by all authors that albuminuria has always been a symptom of disease, but of late many authorities have admitted that albuminuria may be compatible with perfect health.

Posner maintains that albumin is always found in the urine, but normally in too small quantity to be revealed by the ordinary reagents. To demonstrate the presence of albumin in normal urine Posner evaporated large quantities of urine at low temperature and tried the different reagents in the concentrated urine. His experiences have been repeated and his views supported by Senator and by Leube, who, however, did not find albumin in all cases. Von Noorden, Winternitz, Lecorché, Talamon, and different other authors do not admit that albumin is a constituent of the normal urine. At any rate, only traces of albumin can be considered as physiological.

Different kinds of albumin may be present in the urine; generally the proteids contained in the blood-serum are to be found,—viz.: (1) the serum-albumin, or serin, and (2) the globulin, or paraglobulin; in most cases both these proteids are present, but in varying proportions. In some cases there may also be found (3) hemialbumose, or propepton, a mixture of different albumoses which are not precipitated by boiling; (4) nucleo-albumin, which has also erroneously been called "mucin"; and (5) pepton.

Five proteids are found in the urine, viz.: (1) serum-albumin; (2) serum-globulin; (3) nucleo-albumin, or mucin; (4) peptoп; (5) albumose, or propepton. The first two are of special importance because of their association with nephritis. Mucin is usually present normally in small amount in the urine. Pepton and albumose should never appear in normal urine. Serum-albumin

in the urine may be due to (1) renal disease or (2) to the pressure of pus, spermatozoa, blood, or elements of tumors. Urine containing these substances will give the albumin-reaction.

Renal albuminuria may be divided etiologically into (1) that following certain febrile diseases; (2) nervous albuminuria, following some diseases of the central nervous system; (3) hæmatogenetic albuminuria; (4) toxic albuminuria; (5) albuminuria of pregnancy; (6) congestive albuminuria; (7) albuminuria due to long-continued exposure. The appearance of pepton in the urine is pathological. It is expected in cases of empyema or other extensive pus-formations: (1) the ulcerative stage of typhoid fever, (2) suppurative processes, (3) pneumonia at the crisis, (4) after childbirth, (5) in carcinomatous affections, and (6) in phosphorus poisoning. T. P. Prout (Phila. Med. Jour., Feb. 10, 1900).

The urine may, of course, also contain albumin in connection with hæmaturia and hæmoglobinuria, but such cases cannot be classed as true albuminuria.

Physiological Albuminuria.—Regarding the origin of the albumin in the urine only guesses can be made; two theories are possible: (1) the albumin may come from the glomeruli; (2) from the tubular epithelial cells.

Formerly the opinion predominated that the fluid which escaped from the glomeruli was albuminous, but that the albumin was absorbed during the passage through the healthy renal tubules, diseased tubular epithelium being unable to absorb the albumin. This has not been proved, however, and most modern authors believe that albumin is not contained in the urine coming from the glomeruli, except when these are diseased or when the pressure of blood in the glomeruli is abnormally great. Runeberg, on the contrary, is of the opinion that albuminuria is caused by low pressure of blood, and supports this opinion by experiments with animal membranes, but experiences with dead membranes cannot be regarded as conclusive for the action of the living kidney.

Von Noorden and different other authors regard the tubular epithelium as the unique source of albuminuria. These epithelial cells are subject to successive disintegration: when this is minimal and successive traces, only, of albumin are found in the urine, the albuminuria is physiological; when the decaying of the tubular-epithelial cells is augmented and quickened by disease, a morbid albuminuria takes place. In his opinion, this theory is supported by the fact that nucleo-albumin, of which the protoplasm of the cells undoubtedly is the source, is always found in normal urine.

A complicating parenchymatous nephritis may exist, as where the endocarditis is caused by diphtheria. The nephritis is generally amenable to treatment, while endocarditis persists. There may be a general atheroma which also involves the renal vessels, leading to arteriosclerotic kidney. This is especially common with aortic insufficiency. When the energy of the heart sinks and the cardiac muscle undergoes fatty degeneration, stasis, followed by cyanotic induration, is found in all the organs. This occurs only in the later stages of aortic insufficiency. Besides this there is, however, another form of albuminuria, characteristic for the early stages of aortic insufficiency and not accompanied by cyanosis, œdema, etc. The urine is not diminished in amount, the specific gravity is relatively low, and the amount of albumin, hyaline and granular casts very slight. Pathological examination of a few kidneys of this kind show that the marked variations in pressure are responsible for certain anatomical changes. The walls of the arteries and capillaries are found much thickened; so that the amount of blood carried to the kidneys must necessarily be less than normal. The liver and spleen

show similar lesions, but never the lungs. V. Leube (Münchener med. Wochen., July 28, 1903).

From a pathological point of view the causes of albuminuria may be divided into three groups: 1. Disturbances of circulation. 2. Changes of the tubular epithelial cells or of the walls of the blood-vessels of the kidney. 3. Changes in the composition of the blood.

1. All disorders of circulation causing a venous renal congestion will increase the blood-pressure in the capillaries of the kidney, and may thus give rise to a transudation of albuminous liquid; when the congestion is very great the urinary tubules may even be compressed and the escape of the urine rendered difficult. When this is the case and when, also, the supply of arterial blood is diminished, the tubular epithelium will be damaged, and the first result of all this is albuminuria. It is very improbable that arterial congestion ever produces albuminuria, although the experiments of Munk and Senator tend to prove the contrary.

2. Changes of the tubular epithelia and the walls of blood-vessels of the kidneys may, as already stated, be due to disorders of circulation, but they may also be caused by different poisons and toxins. When albuminuria is chiefly caused by degeneration of the tubular epithelia, their protoplasm dissolves in the urine, and nucleo-albumin in great quantity is contained in it, combined with serum-albumin and globulin.

Urinalysis of 400 cases of variola, showing that albuminuria is met with in 95 per cent. of cases, 32 per cent. having abundant albumin. The albuminuria is subject to marked oscillations in amount, and may be absent on certain days. The maximum amount is usually present at the beginning of the febrile period, less commonly during suppuration and desiccation. The albumin often appears in considerable amount when solid food is first taken and when the patient is allowed to get out of bed. Albumin was present in the urine in 75 per cent. of the cases during convalescence, usually in very small amounts. As a general rule, there was abundant albumin in the severe cases. There is no such thing as a distinctive albuminuria of convalescence. The albuminuria is due to a lesion of the kidneys, this lesion being of either the interstitial form or of the epithelial form. Some chronic lesion of the kidneys practically always persists, being, however, extremely slight, as a rule, and causing practically no symptoms. F. Arnaud (Revue de Méd., May 10, '98).

Albuminuria accompanying lithæmic attacks can only be due to irritation or delicate kidney-structures of child, resulting from attempt at elimination from blood of poisonous and irritating products which are causes of lithæmic attacks. Not infrequently small quantity of albumin found in infants and children suffering from acute lithæmic attacks. Autointoxication is responsible for this albuminuria either in early or late life. In middle or later life it is due to arteriosclerosis developed by this autointoxication. Comparative infrequency of lithæmic albuminuria in late childhood and early adult life is due to better developed and more resisting structure of kidney and to the fact that arterial changes found in old lithæmics have not yet had time to develop. Rachford (Pediatrics, July 1, '98).

Toxæmia of pregnancy is that condition which occurs as the result of presence in excess of toxic material; so far as is known, the poison is of the nature of an alkaloid or alkaloids. The excretion of waste-material is mainly effected through the kidneys, and this may account for the albuminuria of pregnancy, rather than mechanical pressure or reflex spasm. Kynoch (Brit. Med. Jour., May 21, '98).

Conclusions of previous researches on subject of albuminuria during pregnancy: 1. In most pregnant women there is a certain degree of autointoxication;

this is the normal toxæmia of pregnancy. 2. In lesions or disease of the kidney or liver the toxic condition becomes aggravated and may lead to grave complications, notably uræmia. 3. Toxæmia of renal origin is the most common, associated with albuminuria and œdema. 4. Albuminuria is not the cause of eclampsia, but a symptom owning a common origin. 5. Grave complications—such as coma, dyspnœa, and paralysis — may prove fatal in the absence of eclampsia. 6. In most cases toxic eclampsia breaks out in albuminuric women; albuminuria is therefore an important precursory sign which should not be neglected. 7. Personal statistics show that 1 pregnant woman in 40 is albuminuric, and that, of 4 albuminurics, 1 develops eclampsia; eclampsia without albuminuria is rare—1 case in 9—and is less serious. 8. Albuminuria alone without eclampsia has often serious or fatal consequences—in 110 cases, 8 women and 20 children died; there were 61 premature labors, 8 post-partum hæmorrhages, and 3 cases of threatened convulsions. 9. Albuminuria should be looked for in all pregnant women. 10. Every albuminuric pregnant woman should be actively treated, a milk diet being the best. 11. In case of threatened danger premature labor is indicated, and gives excellent results. Charles (Jour. d'Accouchements, Apr. 3, '98).

By many the malarial poison is regarded as an efficient cause of chronic nephritis. Out of a series of 712 cases of malaria studied personally, only 3 were found suffering from chronic nephritis; and in 2 out of these it was probable that the renal affection was due to causes other than malaria. It would thus seem that malarial fever cannot be regarded as a cause of nephritis in the sense that scarlatina, diphtheria, etc., are. J. H. Brownlow (Amer. Med. Times, Mar., 1900).

Case in a man, aged 41, suffering from an acute articular rheumatism, with a mitral systolic murmur, the urine containing albumin and casts. Under the usual treatment he recovered in three weeks. Four recurrences were attended by albuminuria, the amount of the albumin decreasing with the decline of the rheumatic symptoms. The heart complication was only temporary. The articular symptoms, the pyrexia, and the renal attack thus constituted a rheumatic symptom-complex. The renal cells had probably been affected by rheumatic toxins. Parkes Weber (Ed. Med. Jour., Jan., p. 48, 1900).

The alterations in the blood which produce the albuminuria and the ascites are due to the presence of toxins which are derived from the gastro-intestinal tract. This fact has been demonstrated beyond all doubt experimentally by Dominicis. In man intestinal antiseptics will cure such cases, and cause the albuminuria and the ascites to disappear. If the treatment is suspended for a time, and the patient allowed to eat beyond his digestive powers, these phenomena soon reappear. Three cases in which the above conditions were noted. G. R. Filocamo (Gaz. Inter. di Med. Pratica, Mar. 31, 1900).

3. When the composition of the blood is altered the urine, very often, will be albuminous. This can be proved experimentally by injecting egg-albumin, soluble casein, hæmoglobin, etc., into the veins of animals, for generally the quantity of albumin excreted after the injection will exceed the injected quantity. Similar results may be obtained by the injection of pepton and propepton, whereas the albuminates are generally inoffensive. Ingestion of a very large quantity of egg-albumin is liable to provoke albuminuria.

Fifty-five cases of nephritis, either chronic or subacute, with albuminuria, in which the hæmoglobin and specific gravity of blood and amount of albumin excreted in urine per day were estimated. There is more or less constant relation between the degree of hydræmia and the amount of albumin excreted. The blood of women is, on an average, about 2.12 lower in specific gravity than the blood of men. The hydræmia bears no relation to the hæmoglobin, but varies inversely as the specific gravity

of the blood. No definite relation appears to exist between the hydræmia and the dropsy; but it seems as if there must be some etiological relation between the albuminuria and the hydræmia. Geza Dieballa and Ladislaus von Ketly (Deut. Archiv f. klin. Med., Sept. 6, '98).

Semmola has tried to prove that albuminuria is always caused by changes of the blood characterized by abnormal diffusibility of its proteids, and, in his opinion, the pathological changes in the kidneys are consecutive to the albuminuria. Though his theory is not generally accepted, Rosenbach has adopted it for the albuminuria which is not caused by nephritis, and regards it in such cases as a salutary and regulating process.

In most clinical cases different causes are simultaneously in action, and it is generally very difficult to determine which is the preponderating etiological factor.

Although albumin is not recognized as a normal constituent of the urine, it is, nevertheless, a fact that traces of albumin, and even a rather considerable amount of it, may be found in the urine of persons otherwise healthy and presenting no symptoms of disease of the kidneys or of the organs of circulation.

Case of intense, continuous albuminuria of seven yaers' duration in an apparently healthy man, 67 years of age, who, seven years before, because of a little disturbance of appetite, had consulted a physician, of whom he learned that his urine contained both sugar and albumin. There was no hereditary taint, no previous illness, no alcoholism or syphilis, that could in any way account for the urinary findings. The most careful examination failed to reveal any lesion in any organ. Dieulafoy, who examined the patient, did not look upon the case as one of Bright's disease, but as a sort of diabetic albuminuria which can be regarded as an exaggeration of physiological albuminuria. M. de Crésantignes (Jour. de Méd. de Paris, p. 125, '96).

Albuminuria after exercise. Specimens of urine from 108 soldiers examined. Albumin was present in 41.73 per cent. of specimens of urine taken before drill, and in 63.23 per cent. of cases after it. Levison (St. Barth. Hosp. Rep., xxxv, 169, '99).

Albuminuria after exertion. Urine of 9 members of the Rugby foot-ball team examined after playing in the final cup tie. In every instance albumin was present, and in some cases hyaline casts also. Herbert Hawkins (Brit. Med. Jour., ii, 1598, '99).

Albumin in the urine after severe exercise. Eighty-three specimens of urine taken from oarsmen at Harvard University, when in training for races, and examined for albumin. Of these, 48 contained albumin. After time-rows and races the urine was invariably albuminous. Darling (Boston Med. and Surg. Jour., cxli, 205, '99).

Cyclical albuminuria has been ascribed by Stirling to the sudden shock of the kidneys from the pressure of blood upon assuming the upright position on arising. The shock from sudden rising plays but slight, if any, rôle. Even when the upright position is assumed very slowly, albumin appears in the urine in such cases. The kidneys are merely unable to stand the increase of pressure that occurs with the upright position.

Cyclical albuminuria is not necessarily related to gout. There is also no evidence that cyclical albuminuria is due to a slight nephritis resulting from a previous attack of acute nephritis. It is a form of albuminuria from venous stagnation, the result of previous inflammation of the kidneys and lack of elasticity of the vessel-walls of the glomeruli. Rudolph (Centralb. f. innere Med., Feb. 24, 1900).

Albuminuria following renal palpation. Renal hæmaturia with albuminuria noted in several cases in which the kidney had been examined bimanually and in which no albumin had been present in the urine before examination. The pressure to which the kidney is exposed causes circulatory changes which permit of the

transudation of serum from the renal capillaries. C. Menge (Münchener med. Woch., June 5, 1900).

Many clinicians therefore admit that albuminuria may be regarded, in some cases, as physiological; this is, however, contested by as many.

Virchow described a physiological albuminuria in infants, occurring in the first days of life, and explained it by the sudden changes of circulation taking place immediately after delivery.

The children of mothers suffering from eclampsia or chronic albuminuria may show this condition from birth. In 10 children whose mothers were non-albuminuric 1 only showed traces of albumin, while in 4 whose mothers were eclamptic 3 showed albuminuria, while the mother of the fourth was only very slightly affected. Albuminuria may thus be transmitted from the mother to the child, and this condition in the child may be prolonged considerably over early infantile life, probably preparing the way for future attacks of nephritis in the course of the ordinary diseases of childhood. Many cases of so-called albuminuria may be hereditary. Should a mother be known to suffer from albuminuria, the children should be carefully examined, and every effort made to prevent the occurrence of scarlet fever or other febrile disorders. Fieux (Jour. de Méd., July 25, '99).

Fleusburg and Sjöquist have recently proved that albuminuria regularly occurs in the first days of life, and that the urine also contains an extraordinary quantity of uric-acid crystals; probably the albuminuria is then owed to the irritation of the kidneys caused by these crystals. Ebstein and Nicolaier have experimentally shown that, when the kidneys are forced to excrete a surplus of uric acid which cannot be dissolved, but goes to the bottom in the form of crystals, the urine commonly contains albumin and sometimes even blood.

Gull found a certain form of physiological albuminuria in adolescents about the age of puberty, especially in weak and pale individuals. Other authors, among whom is Quain, have noticed that this condition is frequently associated with masturbation.

Slight traces of albumin met with extremely commonly, especially between the ages of 18 and 25 years. The urine found to be albuminous in 45.5 per cent. of 129 hospital patients between these ages. Levison (St. Barth. Hosp. Rep., xxxv, 169, '99).

Physiological Albuminuria and Life-insurance.—The question of physiological albuminuria in adults has been much discussed during the past few years and has particularly engaged the interest of the medical men employed in insurance-work.

Statistics of life-insurance, etc., showing that physiological albuminuria is met with in America in 2 per cent.; in England in 3 per cent. Privations, scanty food and clothing, unsanitary surroundings, cold bathing, severe physical exercise, and mental strain frequently give rise to albuminuria. Shepherd (New Eng. Med. Monthly, '89).

Albuminuria, natural or artificial, never occurs except as the result of pathological changes in the kidney, and is consequently never normal or physiological, and is never to be regarded without distrust. Millard (N. Y. Med. Jour., May 9, '91).

Instance where a special examination of a case was referred to author by the medical officers of a prominent life-insurance company with a mere trace of albumin in the urine. He sought and found other evidence of a renal involvement, and advised strongly against the risk; another company accepted the risk for $10,000, and, before the second annual premium, the patient died. Purdy (N. Y. Med. Jour., Feb. 28, '91).

There is at present a tendency to underrate the importance of albuminuria in life-assurance. While the possibility of ephemeral and unimportant attacks in

adolescents is undoubted, the presence of albuminuria in persons of over forty years is very significant. F. de Haviland Hall (Brit. Med. Jour., Feb. 20, '93).

The presence of albumin in persons over middle age of exceeding importance, especially the variety of albuminuria in which, with a low specific gravity, the quantity of albumin present is only to be perceived with the greatest care. This form is indicative of gout of the kidney: a form in which the disease might advance to such an extent as to threaten the life of the patient, though the merest trace of albumin might be present in the urine. If properly treated with a non-nitrogenous diet and warmth to the surface, these cases might go on for years. Lauder Brunton (British Med. Jour., Feb. 20, '93).

It is necessary, especially in women, to take steps to ascertain that the albumin in the urine is not of extravesical origin. One frequent cause of the presence of albumin in the urine of females is hæmorrhagic endometritis. Routh (Brit. Med. Jour., Feb. 20, '93).

Necessity of having the patient urinate in the presence of the examiner, in order to prevent the substitution of other urine. Mackenzie (London Lancet, June 16, '94).

Quite young subjects who have albuminuria should be considered as below the average. Douglas Powell (London Lancet, June 16, '94).

Albuminuria is not always pathological; and, if albumin be not found at the second or third examination, the case should be recommended for acceptance. Symes Thompson (London Lancet, June 16, '94).

In cyclical albuminuria the prognosis is generally admitted to be good, although it is commonly assumed that the kidneys in such cases are specially vulnerable. If this be so, it is remarkable that the occurrence of fevers, even scarlet fever, does not produce a notable increase in the amount of albumin. The contrary may, in fact, occur, as in one of Keller's cases, in which the amount of albumin was actually diminished during an attack of scarlet fever, the favorable influence of rest in the recumbent attitude more than counterbalancing the unfavorable influence of the febrile attack. Editorial (Practitioner, June, '97).

Physiological albuminuria believed to be due to ingestion of a greater amount of albumin than the individual can perfectly oxidize, result being excretion of albumin. The habit of overeating is usually associated with this condition. W. H. Porter (Columbia Med. Jour., vol. xx, No. 4, '98).

The mass of evidence which has come to us of late from the autopsy-table shows conclusively that chronic nephritis exists and is an unrecognized cause of death in a proportion of cases far beyond ordinary belief, and the comparison of carefully kept records of cases before death with autopsy findings shows that little reliance can be placed on the mere urinary examination, either positive or negative, as a means of absolute diagnosis or prognosis of Bright's disease. The writer's own experience leads him to believe that (1) Bright's disease may exist without the ordinary urinary manifestations,—viz., albumin or casts: (2) albumin and casts may be found in the normal urine and do not necessarily mean Bright's disease; (3) given a case of chronic Bright's disease with albuminuria, the fact of its presence, its constancy, or its amount has absolutely no prognostic significance. C. A. Tuttle (Jour. Amer. Med. Assoc., Mar. 31, 1900).

Series of experiments show that the albumin present in nephritic urine is derived from the blood and is different from the specific kidney albumins. L. Aschoff (Lancet, Sept. 6, 1902).

It is characteristic of physiological albuminuria that the quantity of albumin is generally small and that the excretion is, in most cases, intermittent, or cyclical. Leube, Pavy, Fürbringer, Klemperer, and many other authors have studied this condition.

Pavy introduced the denomination "cyclical albuminuria" for the cases in which the albuminuria ceases and returns at regular intervals.

Pavy likewise insists upon posture as the invariable cause of cyclical, or intermittent, albuminuria, the excretion ceasing when the subject is in the recumbent position and going on only when he is walking or standing. The cycles are commonly completed within the day, but in a case narrated by Klemperer there were two cycles, the maximum of albuminuria taking place in the forenoon and afternoon.

In many instances bicycling gives rise to an albuminuria that cannot be distinguished with the microscope from that of genuine kidney disease, but one that must be looked upon as physiological, since it disappeared within a few days after cessation of the exertion, leaving absolutely no signs of disease. Observations made on twelve bicyclists, eight of whom were trained and four untrained. Among the eight trained wheelmen there was only one whose urine contained albumin before the exercise, but after it the urine was albuminous in seven. In six of them, including the one whose urine was free from albumin, there were at the same time present in the urine casts in numbers as great as are generally met with in acute or chronic parenchymatous nephritis; and the two others had a few hyaline casts. Most of the casts were hyaline; the minority showed distinct renal epithelia and were granular. Free renal epithelia were found in every instance. White blood-corpuscles appeared sparingly, but red corpuscles were not met with at all. Among the four untrained wheelmen, in all of whom the urine was free from albumin before the exercise, two showed albuminuria and one cylindruria after riding from an hour and a half to three hours. Mueller (Münchener med. Woch., No. 48, '96).

Three cases of intermittent albuminuria which occurred in the same family. As often as six times, based upon as many observations, attention has been called to the family character of this disease. In the family of the children mentioned above gout is hereditary: a very important fact as regards the etiology of the disease. Lacour (Lyon Méd., No. 25, '97).

Albuminuria, particularly cyclical or irregular albuminuria, may be frequently due to gastro-intestinal autointoxication. Case in which hydatid cysts of the liver caused marked constipation and icterus and distinct albuminuria; latter disappeared after operation upon the cysts and recovery from disturbed condition of digestive organs. The function of the liver and of thyroid gland is particularly important in such albuminuria, since disturbance of either organ may lead to production of toxic substances which cause albuminuria. A. Praetorias (Berliner klin. Woch., Apr. 4, 11, '98).

There is an affection which may be called postural albuminuria. Its characteristic feature is albuminuria on rising from bed in the morning, usually passing off in the course of the day. It is most common in boys and young men, especially those who are studying hard. It is not due to food, does not appear if the patient remains in bed to breakfast, and disappears quickly on lying down. It is obviously in relation with the erect posture after a night's rest in bed, and with imperfect cardio-vascular adjustment to the changed hydrostatic conditions. The amount of albumin may be very small, but it is usually very considerable. Its recognition is important, as the treatment required is the exact reverse of the usual milk diet and protection from cold and fatigue. The most common antecedent is a neurotic family history and cardio-vascular instability. The pulse varies greatly in frequency and is greatly influenced by changes of position. The violent cardiac impulse is due to forcible action of the right ventricle, the apex beat being weak, and the second sound is reduplicated on lying down. The prognosis is favorable, all the treatment usually required being good simple food, fresh air, and vigorous exercise. Tonics may be useful and constipation should be corrected. If these cases are treated for renal disease they usually go from bad to worse, and become confirmed nervous valetudinarians. Broadbent (Brit. Med. Jour., Jan. 2, 1904).

The diagnosis of physiological albuminuria ought not to be made except in cases when persons presenting no other

symptom of disease excrete, constantly or intermittently, a urine containing a scanty quantity of albumin, but no morphotic elements and especially no casts. The centrifugal apparatus, now coming into general use, will certainly contribute to restrain the number of these cases.

Even when no casts can be found, albuminuria ought never be regarded as absolutely inoffensive. Although a cyclical albuminuria continuing years may be compatible with perfect health, still many authors (Johnson, Greenfield, Bull, etc.) are of the opinion that it signifies the first stage of the evolution of granular atrophy of the kidneys. The albuminuria often found in parturient women (Aufrecht saw it in 56 per cent. of all cases) must also be regarded as physiological.

Protest against the indiscriminate rejection of candidates for assurance on account of albuminuria: that is, after a merely chemical examination of the urine. In every case in which albumin is found microscopical examination of the sediment obtained by centrifugalization is essential for the avoidance of unnecessary rejections. There are two fundamentally distinct forms of albuminuria, the renal and the extrarenal. The latter is indicative merely of a functional or organic lesion of the genito-renal tract, which is not necessarily or even usually dangerous to life. Extrarenal albuminuria is characterized by its transitory and intermittent nature. Since, however, some forms of renal albuminuria are equally transitory and intermittent, the final distinction between the two is based on the microscopical examination of the sediment. The presence of blood, pus-cells, epithelium from the mucosa of the urinary tract, spermatozoa, and shreds of mucus, in the absence of renal elements, is decisive of an extrarenal origin. Probably in many cases of so-called physiological albuminuria the origin of the albumin is extrarenal. Zechnisen found albumin in the urine of 21 out of 144 ophthalmic patients; in 60 per cent. the presence of blood, vesical or urethral epithelium, pus, or spermatozoa pointed to an extrarenal origin. Von Noorden found albumin in the urine of 154 apparently healthy soldiers, which in 106 originated extrarenally. Flensburg examined the urine of those soldiers in which he had unexpectedly found albumin at the end of their two years' service; in the majority every trace of albumin had disappeared, and in the remainder there was no single symptom of nephritis. In every case of albuminuria the presence of blood should be excluded, for traces of blood too minute to be detected by Heller's or the spectroscopic test will nevertheless give the reactions of albumin. In extrarenal albuminuria nucleo-albumins preponderate. In doubtful cases the urine should be obtained by catheterism, so that every source of contamination may be avoided. Albuminuria of renal origin may be either temporary or permanent, functional or organic. Organic lesions are characterized by persistence. But persistence is not an absolute bar to acceptance, for cases occur, though rarely, in which albuminuria with renal casts continues indefinitely without any disturbance of health. If, however, there are polyuria, casts, cardiac hypertrophy, or dilatation, arteriosclerosis, retinitis, uræmia, and œdema, nephritis is obviously present. Every case should be judged on its merits. Even without albuminuria, endarteritis, or any one of the above-mentioned symptoms, combined with persistently-increased diuresis and a specific gravity between 1.010 and 1.012, is extremely suggestive of an organic renal lesion. The functional form of renal albuminuria is transitory or intermittent, and is principally due to intoxication or autointoxication. The toxic symptoms produced must decide in each case whether the applicant should be accepted. The most important variety is that which occurs after exercise, and which points to a metabolic instability which may possibly become dangerous. Renal albuminuria which persists during convalescence

from infectious diseases is of no more significance as a sequel than slight bronchitis; if there are no cardiovascular changes the candidate may be passed. Some of the most difficult problems are connected with cases of ascending infection from the bladder. If the process is tuberculous, the candidate should clearly be rejected. In other cases the question whether the kidney is involved will be decided by the effect produced and the condition of the heart and arteries. Many cases of functional albuminuria are due to circulatory disturbances. Of this nature is probably that form known as "cyclical," or "postural," in which there is usually some circulatory disturbance, as evidenced by cardiac dilatation, tachycardia, palpitation, or anæmia, though doubtless heredity and other factors are involved. It is the rule to reject these applicants; but, as the prognosis is usually excellent, there is no reason why they should not be accepted after a period of probation. This form of albuminuria is practically identical with the albuminuria of cardiac disease. Stokvis (Brit. Med. Jour.; from Wiener med. Woch., May 3 and 10, 1902).

Pathological Albuminuria. — Pathological albuminuria is found in pathological changes of the blood—as anæmia, leukæmia, pseudoleukæmia, scurvy, icterus, and diabetes—even when the kidneys do not present pathological changes.

It is also found in many disorders of the nervous system, as epilepsy, migraine, psychosis apoplexy, neurasthenia, and Basedow's disease, etc. Delirium tremens has also been mentioned as a nervous disease often complicated with albuminuria.

Delirium tremens is always accompanied by fever and is probably provoked by a microbic toxin or an autointoxication. Jacobson (Hospitalstidende, p. 193, '97).

Although the kidneys, theoretically, are believed to be healthy in the diseases mentioned above, there is no doubt that albuminuria, in many cases of this class, is caused by pathological changes of the kidneys.

In all febrile and especially in all infectious diseases albuminuria is a very frequent symptom. It has been noticed in enteric fever, diphtheria, variola, after vaccination, in erysipelas, influenza, rheumatic fever, etc. In these cases the albuminuria is caused by changes in the composition of the blood, increase of blood-pressure, rise of temperature, and finally by changes in the structure of the kidneys, especially of the tubular epithelial cells.

Albuminuria has been observed in diseases of the intestines, dilatation of the stomach, ileus, ruptures, etc., and in renal venous congestion caused commonly by disease of the heart or the great vessels.

Albuminuria may be produced by intestinal disorders in children; may be due to the injurious action on the renal epithelium of the toxic products of abnormal fermentations. Jacobi (N. Y. Med. Jour., Jan. 18, '96).

It is present in all diseases of the kidneys. Acute as well as chronic albuminuria is generally found, whether the diffuse form of nephritis or as circumscribed diseases—such as infarctus, abscesses, or tumors—be present. After retention of urine the portion of urine first passed is frequently albuminous.

Certain remedies may also give rise to albuminuria.

Case of a syphilitic subject who, after antisyphilitic treatment with 4 1/4 ounces of mercurial ointment and the iodide of potash, developed œdema of the lower extremities, and 8 per cent. albumin in the urine. Another attempt at treatment by inunction caused the albumin to increase to the enormous quantity of

60 per cent.; after discontinuing it he slowly recovered, while the albumin decreased decidedly in amount. Saalfeld (Deutsche med.-Zeitung, No. 1, '95).

Chlorate of potash, which is often used to prevent mercurial stomatitis, is frequently the cause of the appearance of albumin in the urine. Case of a young physician who died after employing small quantities of this drug in a mouth-wash. Acute poisoning by this drug is easily recognized by the large quantity of albumin and blood in the urine. Mankiewicz (Deutsche med.-Zeitung, No. 1, '95).

Case in which albuminuria and uræmia were apparently produced by the application of a blister. Huchard (Revue de Thér. Medico-Chir., Apr., '96).

Examination of 8000 specimens of urine derived from 201 syphilitic men, 79 syphilitic females, and 35 persons who were not syphilitic. Albuminuria found in 25 of the men, and in the women marked albuminuria in 4 cases. In 35 cases of bubo, the urine of which was examined 363 times, a trace of albumin was only found on 2 or 3 occasions. The administration of mercury in no case gave rise to very marked albuminuria. Lewin, who has used hypodermic injections 80,000 times with sublimate, has never seen nephritis result. It seems evident that the bichloride is the preferable preparation for hypodermic injections. Julius Heller (Schmidt's Jahrbücher, No. 1, '97).

The prognosis and treatment of albuminuria, therefore, depends entirely on the origin and causes of it, and the reader is referred to the various diseases in which it occurs as a symptom.

Tests. — By means of the tests commonly employed the presence of albumin in the urine is revealed, but no attempt is made to discern between the different proteids; the differential diagnosis between the serum-albumin, globulin, etc., will be given later on.

The sample of urine to be examined must be very limpid without deposits of any kind; if this be not the case, the urine should be filtered previous to the examination, because a slight cloud of coagulated albumin will only be discernible when the fluid is very clear before the reagent has been added. When the urine contains many bacteria, even repeated filtration will be insufficient to make it clear; this can then be done, however, by addition of a solution of sulphate of magnesia and of carbonate of soda. By shaking the mixture a precipitate of carbonate of magnesia is formed, and when this is removed by filtration the filtrate will be perfectly clear. In many cases a few drops of caustic soda will clear the urine, but urine treated in this manner will not give a precipitate of albumin by boiling, while the test of Heller is practicable also in this case.

Test by Boiling.—A few cubic centimetres of urine are heated to the boiling-point and some (5 to 10) drops of nitric acid added. When the urine is acid the albumin will ordinarily coagulate by boiling alone and precipitate as a whitish powder or in small flakes. The nitric acid is nevertheless in all cases to be added, as well in order to complete the precipitation of albumin as to avoid mistakes caused by the presence of a precipitate of phosphates or carbonates, —which will immediately dissolve when nitric acid is added. This test is very delicate and will reveal 0.01 to 0.005 per cent. of albumin. Instead of nitric acid, acetic acid can be employed, but while the nitric acid is to be added after boiling and in a quantity of 5 to 10 drops, acetic acid is added before the boiling, and only a sufficient quantity should be employed as to make the urine but slightly acid. This is especially necessary when the urine is alkaline, because the alkaline albuminates with a surplus of acetic acid give a compound which is not coagulated by boiling.

Heller's Test.—Three to four cubic centimetres of urine are poured in a test-tube and two cubic centimetres of nitric acid are cautiously floated down along the sides of the tube. The nitric acid collects on the bottom of the test-tube, and where the fluids are in contact a distinctly limited disk of grayish-white precipitate will appear. When only traces of albumin are present the precipitate will only take place after some minutes. The more or less distinct violet coloring which also appears at the point of contact of the two fluids is due to decomposed indican. This test is very delicate and reliable; 0.003 per cent. of albumin is revealed by it.

Fallacies. — By the addition of nitric acid the urates are also precipitated; these will not form a limited disk, but render the urine turbid. Resinous acids (copaiba) are precipitated by nitric acid, but are dissolved by the addition of concentrated alcohol.

> Urea may also become a source of error by giving a precipitate of nitrate of urea. Long (N. Y. Med. Jour., Apr., '91).

Test by Acetic Acid and Potassic Ferrocyanide.—The urine is rendered acid by acetic acid, and some drops of a solution of potassic ferrocyanide are added. This reagent, the serum-albumin, the globulin, and the albumoses are precipitated, while none of the normal constituents of the urine are (Huppert).

Heynsius's Test.—A still more delicate test than Heller's is that of Heynsius, by acetic acid and sulphate of soda. The urine is rendered acid by acetic acid, and an equal volume of a saturated solution of sulphate of soda (or of common salt) is added. The mixture is boiled, and all kinds of albumin will then be precipitated in white flakes.

The Magnesium-Nitric Test (Roberts's). — One cubic centimetre of nitric acid is mixed with five cubic centimetres of a saturated solution of sulphate of magnesium, and a small quantity of this mixture is added to the urine. The albumin will be precipitated as a distinct ring.

Metaphosphoric acid (Hindenlang) also precipitates albumin in the same manner as nitric acid; but this test is not as delicate as that of Heller. The solution of metaphosphoric acid must be freshly prepared for use, as the solution easily changes to orthophosphoric acid upon standing, which does not precipitate albumin.

Picric-Acid Test (Johnson).—A few drops of a saturated solution of picric acid will cause a white precipitate when albumin is present; this test is only indicative of the presence of albumin, however, when the precipitate appears immediately. After some time the urates and the creatinine will also be precipitated (Jaffé).

Fallacies.—By addition of picric acid the peptons, the resinous acids,—such as those of copaiba,—and alkaloids—such as morphine—are precipitated.

Perchloride-of-Mercury Test.—A 5-per-cent. solution of perchloride of mercury will precipitate albumin in urine which is rendered acid by addition of a few drops of acetic acid.

Fallacies. — Xanthin is also precipitated by this reagent.

Millen's Test.—A solution of nitrate of mercury is added to the urine and the mixture heated to boiling. Nitrate of potash is then added; the albumin presents as a precipitate of red flakes.

Tanret's Test. — The reagent of Tanret is composed of perchloride of mercury, 135 grammes; iodide of potash, 3.32 grammes; glacial acetic acid, 20 cubic centimetres; distilled water, sufficient to make 100 cubic centimetres.

Some drops of this mixture are added to the urine, and will coagulate the albumin. It will also, however, precipitate the urates. Many other reagents have been recommended, which cannot be mentioned in detail.

A small crystal of trichloracetic acid is added to 1 cubic centimetre of urine previously filtered; when the acid dissolves a sharply-defined zone of turbidity arises on the juncture of the clear urine and that saturated with the acid. Raabe (Merck's Bull., Apr., '91).

A solution of carbolic acid in absolute alcohol is a very delicate test for albumin in the urine, comparing very favorably with nitric acid. The urine should first be diluted until the specific gravity is about 1.010; a few cubic centimetres of carbolic acid is then poured on top of this, and a white ring is immediately formed, from which milky drops fall to the bottom of the tube, and adhering to this are the flakes of albumin. The test is sufficiently delicate to show 0.000012 gramme in 1 cubic centimetre of urine. W. Colquhoun (Lancet, May 6, 1900).

Xanthoprotein Test.—Albuminous urine heated with a surplus of concentrated nitric acid will take a yellow color, and some of the albumin coagulates in yellow flakes, which are soluble in alkalies with an orange-red color.

Transportable Reagents for Albumin.—Hoffmann and Aazette employ strips of test-paper previously placed in a solution of the double iodide of potassium and mercury until saturated, then removed and dried. The urine which is to be tested should be clear and rendered acid by means of a few drops of acetic acid. If there be albumin present, upon immersion of a slip of paper in the urine a distinct precipitate will appear.

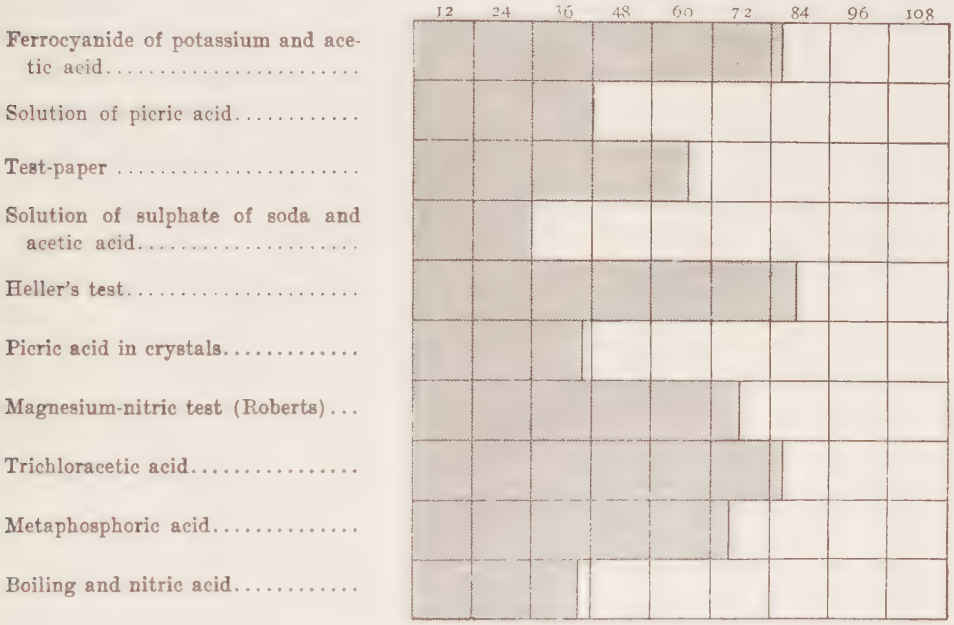
Pavy recommends test-pellets containing ferrocyanide of soda and picric acid; when albuminous urine is well shaken with a parcel of the pellet, albumin will be precipitated. The relative delicacy of the tests most frequently employed is graphically represented by Unger-Vetlesen, in the diagram shown on the opposite page. The longest columns indicate the most delicate tests.

Sulphosalicylic acid, a white crystalline substance produced by heating salicylic acid with concentrated sulphuric acid, precipitates all proteid substances. It shows traces of albumin in a dilution of 1 to 50,000. This reagent was first discovered by Reoch, then by MacWilliam, who employs sulphosalicylic acid in the form of a saturated solution. Personally employed by adding some of the crystals to a small quantity of filtered urine contained in a test-tube. The tube is then shaken. If albumin is present, a white homogeneous precipitate appears instantly. The urine should be acid. If the urine is alkaline it effervesces after the sulphosalicylic acid is added. If albumin is presented in the smallest traces, a cloudiness appears. When nitric or acetic acid is used for tests, small traces of albumin give rise to stringy, multiform particles suspended in a clear menstruum, the interpretation of which often gives rise to doubt. Sulphosalicylic acid gives a uniform opalescence which is unmistakable. Richard Stein (Med. Record, Jan. 16, '97).

Fifty samples of urine investigated each of which, from character of sediment, was judged to contain albumin. Those urines were selected in which small traces only of albumin were assumed to be present. With Millard's test, reaction was obtained in forty-eight of the fifty specimens. Two samples showed no reaction with any test; so that with Millard's test comparative efficiency would be 100 per cent. Roberts's test showed 86 per cent.; potassium ferrocyanide, 66 per cent.; nitric acid, 60 per cent.; heat, 52 per cent. Dilutions up to 1 in 320 showed positive results with all the reagents. When strength was reduced to 1 in 640, only Millard's test showed reaction, and the limit to the reaction was about 1 in 1280. Unless pepton is present in large quantities, it is not precipitated by action of Millard's reagent. J.

W. Garratt (N. Y. Med. Jour., July 16, '98).

A glass pipette is used and the urine allowed to run up the tube one or two inches. The index finger is then placed on the top and the urine washed and dried off the outside of the tube. It is then inserted into nitric acid and the index finger partially removed to allow the acid to flow up the tube. The presence of albumin always causes a white ring to form at the line of contact. Globulin, albumoses, and peptones may also cause a small ring at the zone of contact, but



they are seldom present. If suspected they may be tested for by boiling the urine. A cloud appears just before the boiling-point is reached, but disappears when boiling occurs. Urates may cause a similar ring. Similar experiments have been tried with twelve other reagents which have been recommended for detecting albumin in urine, but the results were never so satisfactory as when nitric acid alone was used. L. N. Boston (New York Med. Jour., May 24, 1902).

Quantitative Tests. — The only method which gives fully reliable results is the gravimetric method. One hundred cubic centimetres of urine are cautiously heated to the boiling-point; if precipitation does not take place a few drops of a weak solution of acetic acid are added; the liquid is now brought on a weighed filter and the precipitate repeatedly washed with hot water. When the water has been removed from the filter by strong alcohol, the filter is dried by a temperature of 120° to 130° C., and the percentage of albumin determined by weighing.

For clinical use several approximate methods have been invented.

Esbach employs an albuminometer,—*i.e.*, a graduated glass tube; this tube is filled to one mark (*U*) with the urine and then to the mark *R* with the test-solution consisting of picric acid, 10 grammes; citric acid, 20 grammes; water, 1 litre. The tube is then closed with a rubber stopper and the contents cau-

tiously mixed. The mixture is allowed to stand undisturbed for twenty-four hours and the quantity of precipitated albumin then read off. The reading indicates in grammes the amount of albumin per litre.

Christensen recommends another method: the albumin contained in five cubic centimetres of urine is precipitated by ten cubic centimetres of a watery solution of tannic acid (1 per cent.). The albumin having been precipitated, 1 cubic centimetre of an ordinary gum-arabic mucilage is added, the volume brought up to 50 cubic centimetres with water, and the whole converted to an emulsion by agitation. Upon a piece of white paper, ruled with black lines 0.5 millimetre wide and at equal intervals, is placed a cylindrical glass measuring four centimetres in diameter. This is half-filled with water, and as much of the emulsion run in as possible without obscuring the black and white lines beneath the vessel. From the number of cubic centimetres required, reference to a table of calculations arranged by Christensen furnishes the proportion of albumin present in the emulsion. When the urine is alkaline it should be faintly acidified with acetic acid before the precipitation of albumin. This test can be made as well by daylight as by the light of a good lamp, and requires only ten or fifteen minutes; but is not applicable to urine containing a small amount of albumin, the variations amounting to two-thousandths.

The polariscope is sometimes employed to estimate the quantity of albumin, but this test is not very reliable. It is true that albumin is lævorotatory, but this is also the case with normal urine, and sometimes the color of the urine is too dark to allow the use of the polariscope.

Miscellaneous. — By the tests above mentioned, as well qualitative as quantitative, the different coagulable proteids contained in the urine are precipitated; it is rarely of any use to differentiate them one from another.

Pure globulinuria without the simultaneous presence of serum-albumin does not occur. In order to precipitate the globulin alone the urine is rendered alkaline with solution of ammonia, after some time filtered, and the filtrate mixed with an equal volume of a saturated solution of sulphate of ammonia. If globulin be present a flaky precipitate will appear.

[The same result can be obtained by using a solution of sulphate of magnesia, which does not precipitate the other proteids of urine, or by diluting the urine until it reaches a specific gravity of 1002 and leading a slow current of carbonic acid through it for two or four hours. After twenty-four to twenty-eight hours the globulin will be precipitated. Levison.]

The hemialbumose, or propepton, which seems to be a mixture of different albumoses, may be revealed by saturation of the urine with chloride of soda and addition of acetic acid. When hemialbumose is present a precipitate will appear which dissolves by the addition of much acetic acid and heating, but reappears when the liquid cools again.

Nucleo-albumin, in small quantity, seems always to be contained in the urine. It is revealed by the addition of an excess of acetic acid to the urine, which becomes turbid, indicating the presence of a larger quantity of nucleo-albumin. When the urine is very much concentrated it should be diluted with water before adding the acetic acid, as the nucleo-albumin is held in solution by the salts of the urine.

F. Levison,
Copenhagen.

ALCOHOL. — Alcohol of the pharmacopœias is one of a series of hydrocarbon compounds, all of which have as their base a radicle called ethyl, whose chemical composition is expressed by the formula CH. Chemically, alcohol is a hydrate of ethyl, or hydrated oxide of ethyl. To distinguish it from other members of the group, particularly fusel-oil (amyl-alcohol) and wood spirit (methyl-alcohol), the alcohol of medicine is called ethyl-alcohol. It is known in the British Pharmacopœia as rectified spirit or rectified spirits of wine, from its being obtained by distillation and subsequent rectification, or purification, from a mash of potatoes or grain, or from wine. What is known as strong alcohol contains 91 per cent., by weight, of pure spirit (U. S. P.), and has a specific gravity of 0.820. Dilute alcohol contains 45.5 per cent., by weight, of pure spirit (U. S. P.), with a specific gravity of 0.928.

Alcohol is usually exhibited in medicine in different diluted forms, known as beverages, which may be grouped according to the percentage of alcohol present in them. The so-called *spirits* (whisky, brandy, rum, gin, arrack) contain about 50 per cent. of alcohol. The heavy wines (port, sherry, Madeira, etc.) contain about 20 per cent., but are usually too sweet for the use of sick persons; when "dry" (free or nearly free from sugar), they are frequently useful to convalescents and to those who are debilitated. The light table-wines (claret, Burgundy, champagne, Tokay, Moselle, hock, and Rhine wines) contain from 5 to 10 per cent. of alcohol; many of the Rhine wines are, however, not suited to those having a tendency to the oxalic diathesis, on account of the oxalic acid which they contain. Malt liquors (ale, stout, beer) contain diastase, which aids the digestion of starchy foods and tends to produce obesity. They are especially tonic in their effects and contain from 3 to 15 per cent. of alcohol.

Pure alcohol is also used in combination with various tinctures and aromatics, to secure accuracy of dosage, to avoid the effects of the more irritating ingredients of poor or bogus liquors, and often in private practice to avoid collision with the prejudices of the laity, or again when there is a tendency toward the abuse of alcoholic beverages.

Dose and Physiological Action.—Alcohol, in prolonged contact with the skin, evaporation being prevented, penetrates the tissues beneath the cuticle, owing to its tolerably-high diffusive power, and excites a sense of heat and superficial inflammation. It may be thus employed as a counter-irritant. Owing to its volatility, alcohol is sometimes used topically to cool the surface of the body. It coagulates albumin, and is sometimes used to cover sores or wounds with a thin, protective, air-excluding layer, which promotes healing.

Taken internally, the effects vary according to the size of the dose taken. When a small dose is taken, it constringes the mucous membrane of the mouth and throat (often used diluted as an astringent gargle in relaxed throat, scurvy, salivation, etc.), and, on reaching the stomach, it produces a sense of warmth, which is quickly followed by a feeling of general well-being, comfort, and restfulness. The heart-beat is sometimes accelerated; the arteries are relaxed. The muscular fibres of the skin are relaxed, and the blood becomes more equally distributed over the different parts of the body; if the extremities are pale and cold, they may resume their natural color and temperature. The glands are stimulated generally; the

perspiration is increased; the amount of urine is augmented, and the secretions of the mucous glands throughout the alimentary tract respond to the increased stimulus. The appetite, when poor, is improved, the special senses rendered more acute, and relaxation and meteorism of the intestines are relieved.

In the stomach a double action is observed on both the gastric juice and the secreting membranes. A small quantity of alcohol produces an insignificant effect on the pepsin of the gastric juice; a larger quantity, however, inhibits or destroys entirely its food-dissolving action. In like manner, a small quantity of alcohol augments the secretion of the gastric juice; larger quantities cause inflammation of the mucous membrane, with increased secretion of a thick, tenacious mucus and a loss of secreting power. The appetite becomes impaired or lost and a feeling of nausea is induced.

Actual state of scientific knowledge on the total-abstinence question. After taking small amounts of alcohol there is an apparent temporary increase of brain-activity, which is but as an evidence of the paralyzing and deleterious effect of alcohol. It destroys the special function of the cerebellum, and produced tremor and weakness of the lower limbs. In chronic alcoholism the dendrites of the pyramidal nerve-cells show swellings and shrinkages, and there is wide-spread pigmentation in the nerve-cells. Even small doses of alcohol at meals have a deleterious influence, and total abstinence must be the course of those who wish to follow the plain teaching of truth. Victor Horsley (Lancet, May 5, 1900).

Alcohol is a narcotic poison. Its food-value under ordinary conditions is practically *nil*, and, put in the most advantageous light, can only be temporary, and then of an extraordinary slight and wasteful character. G. Sims Woodhead (Edinburgh Med. Jour., Aug., 1901).

Series of experiments to determine the influence of alcohol upon the secretion of the gastric juice: upon a case of gastroptosis, one of hysteria, one of atony of the stomach, after gastro-enterostomy, and one of gastro-enteritis. The alcohol was administered per rectum, and the patient took no nourishment by the mouth. It was found that the enema caused an active secretion of gastric juice provided the amount of alcohol was not less than 7 to 10 cubic centimetres. The acidity reached its maximum about an hour after the injections, and then gradually decreased. In two cases of achylia due to carcinoma of the stomach no effect was observed. R. Spiro (Münchener med. Woch., No. 47, 1901).

The effect of alcohol on the circulation in the sick, and its effect on the power of man's blood to resist infection, studied experimentally. Only the results of study of the first of these two problems are now reported. The following facts, regarding the action of alcohol, the author considers as already established by the investigations of many observers: (*a*) In health alcohol can replace the fats and carbohydrates. Whether it can replace the proteids is not yet settled. Alcohol is both a food and a poison. *(b)* In the stomach alcohol disturbs the digestive process to a greater or less degree. After absorption it exerts through the nervous system a temporary increase both in the secretion and in the motility of the stomach. On intestinal absorption, so far as known, alcohol exerts little or no influence. *(c)* In healthy people and in persons with cardiac and renal diseases alcohol has no considerable diuretic power. In healthy people it rather decreases than increases diaphoresis. *(d)* The labor of respiration is increased by alcohol, yet there is no increase in the amount of O absorbed nor in the quantity of CO_2 given off. To the above facts regarding the action of alcohol he adds the following determined by his experiments: 1. The action of alcohol upon the circulation is *nil*. Neither the maximum nor minimum blood-pressure showed any variation that could reasonably be attributed to the action of alcohol. 2. From the study of 309 patients suffering from a great variety of diseases it

would seem that alcohol, in therapeutic doses, has no effect on the temperature, pulse-rate, respiration rate, appetite, delirium, and secretions. These observations should not, however, be interpreted as proving that alcohol is useless or useful in disease. R. C. Cabot (Boston Med. and Surg. Jour., July 23, 1903).

Alcoholic Poisoning. — The toxic effects of alcohol are those of an irritant poison, and may be acute or chronic. The *acute form* of alcoholic poisoning occurs when an excess has been taken at once or within a short interval of time. In the milder form the ingested alcohol produces intense irritation of the stomach, with increased secretion of a mucus altered in character, nausea, and vomiting. The kidneys are the seat of irritation, the result of which is an increased secretion of urine. If the irritation be too intense, the glomeruli may become so swollen as to diminish or even prevent the secretion of urine, in which latter case acute temporary suppression of urine results. The blood becomes charged with the abnormal products (through the abnormal condition of the stomach and its secretions), and these are excreted by the renal organs in the form of uric and oxalic acids, oxalate of lime, and urates; and, from overstimulation of the nervous system and excessive glandular activity, the triple phosphates, with altered pigment-matter; so that, following an alcoholic excess, a large quantity of pale urine is followed later by a highly-colored, strong-smelling secretion. When enormous quantities are ingested, more serious symptoms, sometimes even followed by death, result. The symptoms point to intense gastro-intestinal irritation, with irritation of the cerebro-spinal system so great as to produce convulsions, coma, or death.

Definite quantities of the different alcohols administered to rabbits by means of œsophageal tube. Three degrees of intoxication were distinguished according to their severity: (1) slight paralysis of motion and sensibility; (2) total paralysis of motion with almost complete abolition of sensation; (3) coma, often ending in death. The toxicity rose with the boiling-point of the alcohol, methyl being least toxic and ethyl coming next, while propyl was twice, butyl three times, and amyl four times as toxic as ethyl. Addition to ethyl-alcohol of 4 per cent. of an alcohol of higher boiling-point increased the toxicity of the former to a marked extent. The addition of 2 per cent. was much less powerful, while 1 per cent. had practically no effect in increasing the toxicity. Conclusion is that the symptoms of acute alcoholism are not due to impurities in the ethyl-alcohol; but it is left an open question whether these may not have some share in producing the more chronic results of alcoholic excess. Baer (Arch. f. Anat. u. Physiol., Oct., '98).

Fatal acute alcohol poisoning in a child six years and three months old, who between 8.30 and 9.30 A.M., on an empty stomach, drank about 3 ounces of whisky. Death occurred by cardiac failure about twenty hours after the drinking of the whisky. M. A. Walker (N. Y. Med. Jour., Aug. 19, '99).

Retardation of the pulse is brought about by an irritation of the vagus centres, and of the peripheral ends of the vagi, in part due to a direct cardiac action. The fall in blood-pressure is due to a direct injurious influence upon the heart-muscle. Ladislas Haskovec (Wiener med. Blätter, Oct. 11, 1900).

Treatment of Alcoholic Poisoning. — The treatment of acute alcoholic poisoning (drunkenness) is best begun by washing out the stomach either by emetics or by the stomach-pump or by ingestion of large quantities of warm water. Complete rest, induced, if necessary, by large doses of one of the bromides, and relief of nausea and depression by large doses

of ammonia (spirit of Mindererus, or aromatic spirit), are of prime importance. The cold pack is also of great use. The use of coffee in large doses (in both acute and chronic cases) refreshes and stimulates the nervous system, and with rest and warmth assures a rapid recovery.

If convulsions and coma are present rectal injections of chloral may be used, followed by the cold pack. Atropine, digitalis, and morphine may also be of service, though the prognosis is usually fatal. The use of warm saline solution enemata has been found very useful. (See ALCOHOLISM.)

Case in a 4-year-old boy who had swallowed two ounces of undiluted whisky. Unconsciousness, shallow respirations, and a weak and rapid pulse supervened in forty-five minutes, the general condition being one of profound collapse. As no vomiting had occurred, the stomach was washed out, and general stimulation resorted to, but without effect. Hot saline injections per rectum were then tried; the child recovered consciousness within an hour, and was apparently well the next day. F. C. Forster (Brit. Med. Jour., May 16, 1903).

Therapeutics. — There is considerable divergence of opinion as regards the use of alcohol in disease. The older view is that it is a valuable agent when judiciously employed, and that stimulants are especially indicated in cases of fatigue, in convalescence from acute diseases, in persons who live a sedentary life, or who suffer from poor digestion, and in others who are prostrated from acute illness. In all these cases a glass of wine or a little brandy diluted with water, taken shortly before or with the food, is thought to stimulate the digestive organs and enable the patient to take more food. Pure alcohol is sometimes given alone or in combination with some bitter tincture, as tincture of calumba or quassia, or compound tincture of gentian or cinchona.

Against dry bacteria, absolute alcohol and ordinary commercial alcohol are wholly devoid of bactericidal power, even with 24 hours' direct contact, and other preparations of alcohol containing more than 70 per cent., by volume, are weak in this regard, according to their content of alcohol,—the stronger in alcohol, the weaker in action. Against the commoner, non-sporing, pathogenic bacteria in a moist condition, any strength of alcohol above 40 per cent., by volume, is effective within five minutes, and certain preparations within one minute. Alcohol of less than 40-per-cent. strength is too slow in action or too uncertain in results against pathogenic bacteria, whether moist or dry. The most effective dilutions of alcohol against the strongly resistant (non-sporing) bacteria, such as the pus organisms, in the dry state, are those containing from 60 to 70 per cent., by volume, which strengths are equally efficient against the same organisms in a moist condition. Unless the bacterial envelope contains a certain amount of moisture, it is impervious to strong alcohol; but dried bacteria, when brought into contact with diluted alcohol containing from 30 to 60 per cent. of water by volume, will absorb the necessary amount of water therefrom very quickly, and then the alcohol itself can reach the cell protoplasm and destroy it. The stronger preparations of alcohol possess no advantage over 60 to 70 per cent. preparations, even when the bacteria are moist; therefore, and since they are inert against dry bacteria, they should not be employed at all as a means of securing an aseptic condition of the skin. Provided the skin bacteria in the deeper parts can be brought into contact with disinfectants, alcohol of from 60 to 70 per cent. strength may be depended upon usually, but not always, to destroy them within five minutes. Charles Harrington and Harold Walker (Boston Med. and Surg. Jour., May 21, 1903).

Series of investigations on effects of alcohol. One ounce of alcohol greatly

reduced the perception (Ach). Capacity for calculating lessened, but, while alcohol lessened the ability to reckon accurately, the work was easier (Vogt). The capacity for physical work increased about one-third after the ingestion of alcohol, but in ten minutes this increase had almost entirely disappeared. It did not really increase the strength. When alcohol is added to the fatigue products of the muscles the depressing effect becomes very marked. Rest after taking alcohol prevents any noticeable diminution in strength; but, if the action demands the utilization of strength, fatigue rapidly comes on (Gluck). The effect of alcohol varies remarkably in different men; the degree of sensitiveness to the poison might at times be less in those not addicted to its use than in those accustomed to it (Rudin).

General conclusion that whoever knows the effects of alcohol will not class this substance among the harmless agents. Kraepelin (Münch. med. Woch., Oct. 17, '99).

According to Harnack, who has closely studied the question, alcohol in small or medium doses exercises simultaneously a stimulating action upon certain functions and a depressing action upon others. This fact should never be lost sight of; otherwise the physician exposes himself to the danger of injuring instead of benefiting his patient. It should also never be forgotten that, even in small doses, the paralyzing action of alcohol is exercised most rapidly and most energetically upon the tonus of the blood-vessels,—the importance of which tonus for the regularity of the circulation and the preservation of cardiac energy is well known. For this reason alcohol should be given with caution in cases in which the heart is already enfeebled, as in acute diseases of long duration, or in convalescence from such affections. It sometimes happens that the patients themselves refuse alcoholics; in which case they should never be compelled to take them, but should be given digitalis instead, which, even in small doses (5 minims in 6 ounces of water), acts solely upon the heart, but in this way establishes the tone of the blood-vessels. The acceleration of pulse, often observed after the administration of digitalis, is doubtless due to the improved nutrition of the cardiac muscle.

Alcohol removes, in great measure, the controlling influence of the smaller arteries on the heart, and causes, also, paresis of the vagus. The result is increase in the number of cardiac beats, dilatation of surface-vessels, a feeling of surface-warmth, with reduction of the temperature of the body. It can scarcely be considered a food, as in itself it contains no one of the constituents of which the body is made. It gives no warmth to the body. This is proved by the thermometer. The disuse of it by deer-stalkers, Canadian hunters, and Arctic explorers is additional proof of this. It gives no strength. It distinctly weakens the muscles. Professor Parkes realized this by experiment in the last Ashantee War. Acting on the same views, the Great Western Railway, during the alteration of rails along the whole line, substituted oatmeal-gruel for alcohol, because the work had to be done with rapidity and with unusual energy. The relief of Chitral tells the same story, and so do our great national games. It does not lengthen life. Long Fox (Bristol Medico-Chir. Jour., Mar., '96).

The contact of strong alcohol with the mucous membranes of the mouth, œsophagus, and stomach acts reflexly through the medulla to cause vasoconstriction, which raises the blood-pressure, and hence stimulates the heart. After alcohol is absorbed (it circulates as alcohol) it causes vasodilation and a fall in blood-pressure. It is certain that overdoses of alcohol after absorption are depressant to the heart-muscle, to the muscle-fibres of the blood-vessel walls, and to the vasomotor centre in the medulla. On these considerations the author bases his advice on the use of alcohol in derangements and affections of the heart.

With regard to the utility of alcohol in combating poisons circulating in the blood, clinical experience is not conclusive. Laboratory experiments should be undertaken in order to settle this point. O. T. Osborne (Jour. Amer. Med. Assoc., December 5, 1903).

Fevers.—While alcohol is very useful in many cases of fever, there can be no reasonable doubt that all cases of fever do not require it, while many cases are best treated without it. The special indications for its exhibition are: general debility; rapid, small, or irregular pulse; the condition known as the typhoid state and recognized by the presence of hebetude, indifference, jactitation, muscular twitching, subsultus tendinum, muttering delirium; coma vigil or even a more active delirium, with signs of great weakness; a dry or brown tongue, sordes, and, perhaps, involuntary evacuation of urine or fæces. If the patient is being benefited by the use of stimulants, the following effects will be observed: The tongue becomes moist; the pulse becomes slower; the skin becomes comfortably moist; the breathing becomes more and more tranquil; sleep is produced; delirium is quieted or disappears.

While alcohol should not be given in every case of fever, certain definite indications exist which imperatively call for its use: 1. Persistence of a high temperature. 2. Persistence of a rapid, feeble, irregular, dicrotic pulse, whether associated with high, low, or irregular temperature. 3. Persistence of marked prostration.

If, however, after giving alcohol the pulse becomes quicker and more irregular, the skin hotter and drier, tongue browner and drier, breathing shallower and hollower, it means that the alcohol is doing no good even if it is doing no harm; it means that the little patient has passed from the stage of depression, in which alcohol is of decided utility, to the stage of exhaustion of the vital powers, in which it is of no value; nor is any other remedy, for that matter. Under such circumstances alcohol had best be discontinued. Depression of vital powers, no matter how alarming, can be successfully combated by alcohol in conjunction with other powerful and quickly acting stimulants. Exhaustion of the vital powers, whether in old age or infancy, means death. A. E. Bieser (Pediatrics, Apr. 1, 1901).

Poisoned Wounds. — Alcohol is a valuable remedy in the toxæmia produced by poisoned wounds, snake-bites, etc., if used immediately and freely. In these conditions the dose is to be regulated by the effect, as very large doses are not only tolerated, but required, to be of any use.

Aconite Poisoning. — Stimulants, freely administered (best by hypodermic injection for rapid action), are useful in this grave condition, in which the whole plan of treatment is directed toward stimulation and the prevention of syncope. (See Aconite.)

Externally. — Alcohol used externally is detergent, antiseptic, disinfectant, astringent, and hæmostatic. These properties make it a valuable agent in the treatment of wounds, especially if the seat of infection. Whisky, plain or diluted (1 to 4), may be used. For non-infected wounds and granulating ulcers the vinum aromaticum (U. S. P.) is a valuable dressing.

In snake-bites and insect-stings, strong alcohol combined with ammonia is a useful lotion after the poison has been sucked out of the wound.

Alcohol (8 p.) combined with ammonium chloride (1 p.), vinegar or dilute acetic acid (4 p.), and water (64 p.) makes a valuable evaporating lotion, which may be perfumed if desired. This is useful in headache; strained and swollen joints, muscles, and tendons; abscesses, erythema, erysipelas, and slight burns. For

bathing fever patients, alcohol is useful, alone, or combined with vinegar when there is diffuse diaphoresis.

Alcohol is used as a detergent, alone, or combined with sodium bicarbonate (2 p.), alcohol (8 p.), water (80 p.), or in the form of soap liniment. Applied to irritated, fissured, or excoriated nipples, dilute alcohol hardens the surface, and coats the raw surfaces with a delicate protective film (by coagulating the albumin in the secretion of the raw surface) and diminishes the sensibility of the terminal nerve-filaments.

Ulcers or aphthæ are benefited by the local application of strong alcohol.

The disinfecting properties of alcohol are asserting themselves increasingly.

A dilution of alcohol of 55 to 100 is toxic to staphylococci and is but slightly inferior to 1-to-1000 corrosive sublimate, and equal to carbolic acid in 3 parts per 100. Alcohol to which is added an alkali for the purpose of saponifying fat greatly increases the disinfecting powers. A dilution of 80 parts in 100 is an exceedingly efficient disinfectant for the hands. G. Fisher (La Presse Méd., July 7, 1900).

Property of alcohol in the sterilization of the hands. It is in abstracting air from the pores and fissures of the skin that the true value of the application lies; a previous treatment with alcohol enables subsequent aqueous solutions to penetrate much more thoroughly and completely into all the macroscopical and microscopical interstices of the cutaneous surface. Braatz (Münch. med. Woch., July 17, 1900).

Permanent applications of strong alcohol of great service in combating all inflammatory conditions in which there is a tendency toward suppuration. It causes a local dilatation of the blood-vessels, and thereby the formation of alexins and consequent greater capacity for resisting the spread of infection. Thick layers of gauze are saturated with alcohol and then covered with some impervious material. The dressing is left in place for days at a time, resaturating it with alcohol once every twelve hours. Graeser (Münch. med. Woch., July 17, 1900).

In disinfection with alcohol the vapor is the effective element. Von Brun (Münchener med. Woch., Feb. 12, 1901).

In the various preparations of alcohol, those with a higher specific weight have more energetic disinfectant action. The most energetic preparation is 40-per-cent. alcohol, which boils at about 90° C. Frank (Münchener med. Woch., Jan. 22, 1901).

Inhalations.—Inhalations of alcohol have proved useful in the treatment of shock, collapse, and the profound asthenia met with in fevers and toxic conditions, especially when alcohol cannot be taken by the mouth or given by the rectum. A 10-per-cent. solution of alcohol may be administered by steam or hand-spray apparatus, or by pouring alcohol or spirits into a vessel of hot water, throwing a towel over the vessel and the patient's head.

Injections. — *Tumors.* — The use of alcohol in carcinoma has been productive of encouraging results. Interstitial injections of very strong alcohol have been used by Vulliet, of Geneva, as a palliative in inoperative cases of cancers of the uterus. The beneficial action obtained this author ascribed to the local ischæmia induced.

Carcinoma of the uterus was also treated in 1878 by Hasse with alcohol, injections being made into the circumference of the growths in three cases with good results. After twenty-three years the patients were alive and well. There had been formation of connective tissue around the neoplasm, obliteration of the blood-vessels, and shrinking of the tumor.

More recently this treatment has been employed in cancer of the breast with encouraging results.

In cases of shock, collapse, typhoid state, and profound asthenia, where stimulants cannot be swallowed, whisky or other spirits may be injected hypodermically, with the advantage of rapid absorption and speedy action, according to some authors, but the belief is gaining ground that it is more harmful than beneficial.

Alcohol is a useful food in the small quantity which increases, but does not impair, digestion; which quickens the circulation and the secreting function of the glands, but does not overstimulate; and which can be oxidized in the body. This amount, says Bartholow and others, is from 1 ounce to $1^1/_2$ ounces of absolute alcohol for a healthy adult in twenty-four hours. All excess is injurious.

M. Duclaux recently declared, on the strength of a number of experiments made on themselves by two American investigators (Atwater and Benedict), that alcohol, so far from being a poison, has in moderate doses a distinct dietetic value. This profession of faith, made as it was just at the time when the Académie de Médecine was, at the request of the Minister of the Interior, drawing up a list of toxic essences employed in the manufacture of liquors, and when the Prefect of the Seine had placarded the walls of Paris with warnings as to the deadliness of alcohol, caused no little scandal among the antialcohol party, who, with the charity characteristic of "anti's" of every hue, even hinted that the opinion of the distinguished successor of Pasteur was not altogether disinterested. This ignoble imputation is mentioned only to show the degree of malevolence and mendacity to which the minds of well-meaning persons can be inflamed by prejudice. In La Revue M. Duclaux states that no definite practical consequences can yet be drawn from the experiments of Atwater and Benedict. He is anxious that the question should be fully discussed, but he awaits the coming of adversaries who will consent to read and reflect before rushing into print. In the meantime he will agree to a truce, accepting as an average one liter of wine a day, an amount which has been shown by the American investigators to be harmless and even useful. The wine must be well diluted with water, and its consumption spread over a day.

Roux, also of the Pasteur Institute, holds that even if Atwater and Benedict's experiments be accepted, the fight against alcohol must still be continued. He thinks that habitual drinkers will never submit to the restricted allowance which Atwater and Benedict imposed on themselves. In regard to wine Roux admits that the experience of centuries as seen in whole nations shows that moderate drinking does no harm. Metchnikoff holds that alcohol in any form is a poison. He confesses, however, that he has not made a special study of the question, and his conclusion is based on his personal experience. He never drinks alcohol himself, as he has found that even a small quantity makes him giddy. Berthelot is clear that alcohol is not a food. In very small doses it may be useful as a medicine. He thinks alcoholism is a factor in the present decadence of most European nations, and that their only hope of salvation lies in vigorous legislation against the evil. Brouardel gives the guarded reply that from the chemical constitution of a body no conclusion can be drawn as to its alimentary value; experience alone can decide the question. Charles Richet says there is no doubt that alcohol is a food, and that in very small doses, when pure, it is almost harmless. This fact, however, does not warrant the inference that it is a good food. He thinks that men must be angels before alcohol ceases to be a great danger. It is a mischievous delusion to think that alcohol is consumed as a food; it is rather its poisonous effects that are sought by unfortunates anxious to forget their misery. Professor Bernheim, of Nancy, does not think that the use of alcohol should be proscribed. He even holds that many abstainers from "the generous wine of France" are actuated by *snobisme*. Wine, he says, is, like other medicines, poisonous only in large doses. It would be as reasonable to forbid its use on

that account as to condemn the eating of meat because it contains ptomaines or eggs because phosphorus enters into their composition. Like everything that we take, wine suits some and not others.

Lancereaux also holds that wine is dangerous only if taken in too great quantity—for instance, in a daily quantity of three litres. Alcohol in every form, however, if taken to excess brings on premature senility and tends directly to tuberculosis and death. Héricourt holds that, to the question, is alcohol a food? no absolute answer can be given. Every food is toxic in certain amounts, and although the consumption of a litre of wine a day may never have been a direct cause of the death of anyone, it may be so indirectly, as by diminishing the power of resistance to disease.

Dr. Landouzy is of the opinion that natural wine taken in doses suitable to age, constitution, and mode of life does not deserve the uncompromising condemnation of intemperate advocates of temperance; he looks upon spirits and liqueurs, however, as, generally speaking, pernicious. Magnan thinks that, whatever chemistry or experimental physiology may appear to show, alcohol can never be recommended as a food. Garnier, speaking from a large prison experience, says that alcohol is responsible for 70 per cent. of all the crimes committed in France. Bourneville is not hostile to wine; he holds, with Duclaux, that from the hygienic point of view it is distinctly useful in moderate doses.

On the whole, then, the weight of opinion among leading scientific men in France is in favor of the dietetic value of wine. But the wine must be pure and it must be taken in moderate amount. Those who, like Cassio and Metchnikoff, have very poor and unhappy brains for drinking ought by all means to avoid looking upon the wine when it is red. They have no right, however, to make this personal idiosyncrasy the measure of other people's tolerance, still less to found upon it a universal law for the governance of mankind.

As to the deadly effects of the abuse of alcohol we are all agreed, and probably all will also agree that its use should be carefully regulated in accordance with individual constitution. The experience of men differs. Gladstone, who had an "open mind" in most directions, tested the matter for himself. He found that wine helped him when he had to make an extraordinary oratorical effort, and the want of it made the effort more laborious and less successful. On the other hand, some find that wine paralyzes their faculties. In regard to alcohol, it may be said with truth that what is one man's meat is another man's poison, and that homely proverb seems to us to sum up the teachings of science and philosophy on the question. Editorial (Brit. Med. Jour., March 14, 1903).

The prolonged indulgence in alcoholic drinks in time produces a chronic catarrhal inflammation of the gastric mucous membranes, accompanied by a proliferation of the connective tissues. This latter, by subsequent contraction, obstructs and finally obliterates the secreting follicles and the cells which line them. In this way the mucous membrane becomes thickened, indurated, and uneven, and covered with a coating of thick, tenacious mucus that excites fermentation, with gas and various acids (butyric, acetic, etc.); whence acidity and heart-burn.

These harmful effects on the stomach are much less marked in fever patients and in those who are convalescing from exhausting diseases.

> In infectious diseases alcohol should never be given unless the patient is near collapse. Even in small doses it weakens the resistance, and so favors the action of the invading microbe. It is a cause of still-born infants, with more or less wide-spread fatty degeneration. Gruber (Wiener klin. Woch., May 9, 1901).

As the diffusive power of alcohol is great, it passes readily into the blood; little finds its way very far into the intestines. The effects of alcohol on the other organs of the body (liver, kidneys,

brain, and vessels), as it passes through them on its way in the circulation, will be considered under POISONING.

Even in large quantities, alcohol appears neither to promote nor to hinder the conversion of starch into sugar.

Parkes and Wollowicz hold that alcohol does not diminish the oxidation of the body. G. Harley found that alcohol, added in small quantities to blood withdrawn from the body, lessened its absorption of oxygen and its elimination of carbonic acid.

As to the effect of alcohol on the body-temperature, it would seem that a small quantity, in a subject not accustomed to its use, causes increased activity in all the bodily functions and a slight elevation of temperature. Considerable doses of alcohol cause a decline in temperature of the body, which is even more marked when fever is present, except in patients in whom a decline of temperature does not follow in doses short of lethal. This reduction of temperature produced by alcohol is, doubtless, referable to the diminished rate of tissue metamorphosis, for it has been ascertained that the excretion of both urea and carbonic acid is lessened by alcohol; the combustion of the nitrogenous and carbonaceous foods is retarded. This action results in an increase of body-weight, as seen in the rotundity of those who take spirits moderately.

The action of alcohol on the heart is most important. When the heart is weakened by debilitating diseases (pulse always quick and weak), it strengthens the contractions and, by its tonic influence on the heart, alcohol strengthens the pulse and reduces its frequency. It stands first as a safe and efficient cardiac stimulant.

The condition of the system causes great variation in the physiological effects of alcohol. In convalescence from acute diseases, in the condition of shock from serious injury, loss of blood, or snake-bites, quantities which would, under normal conditions, cause intoxication, are taken with impunity.

The extremes of life (infants and the aged) bear alcohol well. Habitual use modifies more decidedly the influence of alcohol on temperature, circulation, and the nervous system.

In the diseases of childhood all forms of gastro-intestinal disturbance can be excluded from the list of diseases in which alcohol is beneficial. In acute cases, even in cholera infantum, large quantities of water with a small amount of black coffee or tea will stimulate better than alcohol, while it is not irritating to the already diseased mucous membrane. It is especially irrational and harmful to administer alcohol in the diarrhœas of children before the stomach and bowels have been freed from all putrefying material.

In the typhoid fever of childhood Seibert rarely gives alcohol. The disease usually runs a mild course and relapses seldom occur if proper diet is adhered to. In pneumonia the enormous quantities of alcohol which are frequently given are irrational; they should only be used when collapse threatens or is present, and then in large doses and in concentrated form. Alcohol-fed children digest less perfectly in pneumonia than others, and do not regain their appetite and digestive power after the attack is over as those do who are treated without it.

Alcohol prepared in the form of pencils, for the treatment of superficial impetigo, sycosis with small pustules, pustular acne, and pustular rosacea. The patient carries the pencil with him, wrapped in tin-foil, and is instructed to rub it over the papules and pustules as

frequently as possible. The formula for the pencils is as follows:—

℞ Sodium stearate, 6 grammes.
Glycerin, 25 grammes.
Alcohol, 100 grammes.

The glycerin is added to prevent brittleness. P. G. Unna (Monats. f. prakt. Dermat., xxxi, No. 11, 1900).

C. Sumner Witherstine,
Philadelphia.

ALCOHOLIC NEURITIS.

Definition. — Inflammation of the peripheral nerves, especially those of the extremities, due to the excessive use of alcohol.

Symptoms. — The first symptom of alcoholic neuritis consists usually in neuralgic and tingling pain, especially in the lower limbs, less commonly in the upper limbs. Long prior to these first painful sensations there generally are feelings of debility, lethargy, anorexia, or uneasiness, with disturbed sleep. The sufferer labors under *malaise*, cannot tell what is the matter, and rarely seeks medical advice till the pains become severe.

Alcoholic paralysis of the upper limb usually affects the muscles animated by the musculo-spiral nerve, and is often complete, which is the opposite of what is usually seen in plumbism.

Wrist-drop and foot-drop occur from the extensors being more affected than the flexors. The facial muscles and the sphincters may be affected in very rare cases. These pains are usually followed by difficulty in walking, which in turn is due to paresis of the leg-muscles and ataxia.

A distinctive walk, called the high-stepping, or pseudotabetic, gait, consists in raising the foot and throwing it forward, the toes hanging down causing the patient to raise the heel, the sole being visible from behind. This "high-stepping" is seen only when foot-drop is distinct. It resembles the gait of a man meeting obstacles while walking.

When the lower limb is affected, and when the patient is lying down, the foot forms an obtuse angle with the leg, its outer edge is lower than the inner, and the phalanges are fixed. The patient cannot move his toes or raise the outer edge of the foot. The foot can be extended on the leg, but only slightly flexed on it. Usually the paralysis begins by the extensor proprius hallucis, followed by the extensor communis and the peronei; the quadriceps may be also affected, and may indeed be the only muscle paralyzed. (J. Babinski.)

> Two cases of paralysis of the left vocal cord due to alcoholic neuritis. In the first case there had been, for fifteen days, such a feebleness of voice that the patient, a clergyman, was unable to fulfill his duties. There was no thoracic affection and no sign of locomotor ataxia. The left vocal cord was in the cadaveric position. The patient gave a history of recent sciatica in the left leg, but accompanied also by a pronounced anæsthesia of that member. The patient, although never drunk, was accustomed to drink a quart of strong, English beer at luncheon and dinner, and in the evening a considerable quantity of brandy. Complete abstinence was enjoined and carried out, and fairly large doses of nux vomica prescribed. By the end of four weeks the voice had completely returned and the vocal cord had regained its normal functions. Dundas Grant (Archives de Laryng., May, June, '97).

Later on, atrophy of the muscles may be noted, supplemented sometimes by degeneration reaction to electricity. The knee-jerk is lost early in the history of the case. The hands and feet may become swollen and congested when allowed to hang down.

Anæsthesia of the legs, and even of

other portions of the body, is frequent. Indeed, disturbances of the sensibility may be noted when motor disturbances are of little importance; the opposite, however, does not occur. On the other hand, paræsthesia may be present, pressure on the muscles and nerves causing great pain. Cutaneous reflexes are sometimes diminished in extent and rapidity.

Convulsions and fever rarely occur. Mental symptoms are occasionally present, but they are frequently slight, amounting only to irritability, unrest, and suspicions.

In a proportion of cases there are delirium and extravagant hallucinations resembling those of general paralysis, the most characteristic being a loss of appreciation of time and place. (Wilks.)

Recent events are forgotten, while ancient ones are remembered. The ocular disturbances of alcoholism are bilateral, symmetrical, and affect both eyes equally. They chiefly consist in a central scotoma, ellipsoid in shape, with the longer axis horizontal; red and green are the first colors not seen. Ophthalmoscopically, the temporal side of the disk is discolored. Paralysis of the motor externus, ptosis, and external ophthalmoplegia have been noted. The pupils may react more slowly than normally to light. (J. Babinski.)

Diagnosis.—Rheumatic pains in the early stages. The failure of sodium salicylate to alleviate the pain, with the temporary lull from opiates, though the pains thereafter persist, soon excludes rheumatism.

General Paresis.—It can be differentiated from this disease by the absence of paralysis of the tongue and lips and of grandiose delusions, by the presence of muscular wasting with wrist- and foot-drop, by the tearing or stabbing pains, by the lost knee-jerk, extreme pain on pressure, and by a feeling of coldness on being touched.

> Alcoholic paralysis is the disease most frequently mistaken for general paralysis. An important differential point is the mode of development of each disease, general paralysis always commencing insidiously, alcoholic paralysis frequently with great suddenness, and it is believed that this sudden development, associated with the perversion of the affections, is almost sufficient to confirm the diagnosis. These features have also been insisted upon by Charpentier. E. M. de Montyel (Revue de Méd., Feb. 10, '98).

Locomotor Ataxia. — In this affection there are girdle pains; urinary and ocular disturbances are almost constant, while atrophic paralysis belongs more especially to alcoholic neuritis. In non-alcoholic locomotor ataxia the toes are raised, but in alcoholic neuritis they hang down. The non-alcoholic comes down on his heel, the alcoholic neuritic on his toes. The paralysis of the former is not so symmetrical and his gait is more uneven and jerky than the latter.

Lead Paralysis.—It may be differentiated from this disorder by the absence of the blue gum-line, and by the much greater prospect of recovery.

Disseminated Sclerosis.—This disease can be eliminated by the absence of head rhythmical tremors, spastic paralysis, and hyperalgesia, which occur in alcoholic paralysis with nystagmus.

From special atrophic paralysis by the absence of pain in the non-alcoholic. From Landry's acute ascending paralysis by the legs being affected first, the arms next, and then the trunk (if at all), and the foot-drop, there being no foot-drop in Landry's, and in the latter the trunk being affected immediately after the legs; besides, Landry's has no muscular atrophy and no alcoholic electrical reaction of degeneration.

From progressive muscular atro-

PHY by the presence of pain and the alcoholic degeneration reaction; so also from chronic anterior poliomyelitis.

From TOXIC HYSTERICAL PARALYSIS by the suddenness of the hysterical onset and cessation.

From CEREBRAL HEMIPLEGIA in that hemianæsthesia is rarely met with in that disease. From various nervous affections of a mixed character.

Etiology.—Alcoholic neuritis is more common in women, and in those who have drunk quietly for a long time. It is especially due to the inordinate use of spirits and alcoholized wines, such as sherry, Madeira, etc.

> Case of alcoholic multiple neuritis following prolonged debauch. In the spinal cord very marked lesions were found in the anterior horns, the posterior horns, the columns of Clarke, and the nucleus of Stilling, and in the ganglion-cells, the changes being especially marked by their great variety. The most common was central chromatolysis. There were also distinct degenerative changes in the cortex of the brain. Fatal alcoholic multiple neuritis causes grave changes in the ganglion-cells characterized by extreme polymorphism. J. H. Larkin and Smith Ely Jelliffe (Med. Record, July 8, '99).
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> A large proportion of so-called alcoholic paralyses occurring in beer drinkers is due to chronic arsenic poisoning, and the author has based this opinion upon his investigation of the large number of cases which occurred in the North of England in 1900 and subsequently. While the epidemic of 1900 was due to contamination of the beer through glucose which accidentally contained arsenic, it has been also found that where the malt is prepared with certain kinds of coke the beer may contain heavy traces of arsenic. Having had recently six cases of the marked so-called "alcoholic" paralysis type in heavy beer drinkers, the author thought it advisable to examine the beer, and the analysis showed that the samples contained about $^1/_{25}$ grain of arsenic to the gallon. Previous to this time in two years this sort of cases had practically disappeared, and the analysis of the various beers consumed in the locality had never shown more than $^1/_{100}$ grain to the gallon. These cases are due not to alcohol, but to arsenic. Reynolds (Brit. Med. Jour., July 25, 1903).

Pathology. — Until recently (1881), when Clarke discovered a softening of certain portions of the spinal tissue, the post-mortem appearances seen had been peripheral. Eichhorst found a few diseased patches in the middorsal region besides disease of smaller vessels throughout, and increase of the connective tissue in the lateral column. Schäfer, Payne, and Sharkey found ganglionic inflammatory changes and degeneration. Pal noted degeneration of Lissauer's posterior root-zone in the lumbar region and general involvement of Goll's columns; in another case degeneration of Goll's columns in cervical region, less marked in the dorsal, appearing again in the lumbar. Thomson found disease of the nuclei of some of the cranial nerves in the pons and medulla oblongata. Hun and Kojewnikoff observed slight degenerative changes in the ganglion-cells of the cortex cerebri. Déjerine and Sharkey have described disease in the vagi and phrenic nerves. Congestion of pia mater has been noted. Campbell also noted these ("Trans. Path. Sec. Liverpool Med. Inst.," vol. xxiii, No. 2, '93). The principal changes have been met with in the periphery, generally limited to the finer nerve-terminations, the morbid intensity diminishing with the distance from the periphery. These degenerative changes are generally symmetrical in the upper and lower limbs, the latter being most frequently involved. This peripheral inflammatory degeneration is parenchymatous, the inflammatory process being secondary to strangulation of the nerves higher up. Sometimes the part affected

is swollen; at other times the microscope alone reveals the lesion, disclosing a dull appearance from fatty myeline degeneration. The degenerated cloudy portion gradually separates till the segments surround the axis-cylinder as fatty particles. In the sheath and intestinal tissues there is a great increase of the nuclei of the sheaths and infiltration with leucocytes, with thickening of the perineurium. Finlay found wasting of the fibres of the wrist extensors, leucocytes and nuclei crowding the interstitial spaces. In peripheral neuritis are found peripheral lesions; in alcoholic insanity and dementia the lesions are central: brain shrinkage and softening, shallowing of interconvolutional furrows, tortuous atheromatous vessels, and ventricular effusion.

In the optic nerves the interstitial tissue is first affected; there are found many healthy fibres, which is the opposite of what occurs in the optic neuritis of locomotor ataxia, and which explains the clinical aspect of alcoholic amblyopia.

> Most important effects of alcohol on the tubular neurin are shrinking and hardening, transmission of impulses being impaired; on vesicular neurin the dissolution of phosphorus, protagon, and lecithin, with selective affinity for the neurin of the cerebellum. Wilkins (N. Y. Med. Jour., Sept. 22, '94).

Prognosis. — Complete recovery may be obtained in the great majority of cases if alcohol be completely renounced. In very grave cases, especially when the patient is not seen in time, total paralysis, and even death, may supervene. The amyatrophy of alcoholic neuritis may become extremely marked, and end in the formation of fibrotendinous retractions.

Treatment. — Alcohol must be given up at once and always. Electrotherapy; cold, tepid, hot, or Turkish baths; sponging, and strychnine preparations are recommended. So also are arsenic, nux vomica, cinchona, and the iodides. The food must be easily assimilable.

ALCOHOLISM.

Definition.—The various pathological changes and attendant symptoms caused by the ingestion of alcoholic beverages.

Varieties.—Two forms are recognized: the *acute*, in which alcoholic poisoning speedily manifests active excitement and disturbance, or in which a sudden exacerbation of the disorders attending the chronic type gives rise to correspondingly marked symptomatic activity; the *chronic*, in which the continued ingestion of alcoholic beverages in more or less appreciable quantities sets up pathological changes, the morbid transformations gradually involving the various organs and tissues and giving rise to chronic disorders of each of the parts thus attacked.

The older denomination of "delirium tremens" is now considered under the heading of "acute" alcoholism, as are, also, acute alcoholic poisoning, intoxication, acute alcoholic insanity, acute alcoholic paralysis (alcoholic neuritis and alcoholic toxic hysterical paralysis), acute alcoholic epilepsy, etc. To make this article more intelligible, it was deemed best, however, to adopt the following subdivisions: Acute Alcoholic Intoxication, drunkenness; Acute Alcoholic Delirium, delirium tremens; Acute Alcoholic Mania, mania a potu; and Chronic Alcoholism, the meaning of which has already been given.

Acute Alcoholic Intoxication.

Symptoms.—Three stages are discernible in this condition. The first is vas-

cular relaxation, when the intoxicated is usually lively, merry, agile, and joyous; all excitement and energy; in the highest spirits, cheerful, hopeful, and communicative; mercurial and confiding, often telling his private affairs to strangers. There is a warm glow of color on his countenance, he looks at his best. Gradually his spirits rise still higher; he becomes more demonstrative in love or in argument, more emphatic in his gestures, more furious in his fun, and very much louder in his laughter, as the second stage is ushered in. With this he is becoming much less reasonable and amenable, incoherence of thought and speech gradually set in, the imagination revels, exaggeration is a prominent feature, and his emotions dominate him, intellect, reason, will, and conscience rapidly fading in the background. In some cases his thoughts, speech, and actions are exaggerated. In other cases these are transformed, the usually modest, retiring man becoming a boaster and a braggart, the truthful a liar, the meek violent. With all this, speech thickens, the lower and then the upper limbs cease to act in unison, the intoxicated cannot stand, but staggers with paralytic drunken unsteadiness of gait, the muscles becoming flabby and feeble. The third stage of "dead drunkenness" reveals an unconsciousness with the pallor of apparent death on the face, extreme coldness, accompanied by total insensibility and an utter disregard of the "world without" and the "world within." Sensation, perception, volition, and emotion, all are absent. Through this living death in the heart and circulation lingers the only spark of vitality which keeps the unconscious drunkard just alive till the faculties, if they do emerge, have emerged from the depth of narcotism into which they were plunged. In some cases the first pleasurable stage and the second, less pleasant, may vary in intensity and duration, but the last insensible stage usually lasts from six to twelve hours. These successive groups of symptoms, or stages, may be described as "the three acts of the drama of intoxication."

Alcoholic acute poisoning is sometimes manifested as epileptic explosions. These are, in some cases, with a known epileptic neurosis, the indirect effect of alcoholic provocation; but there are other cases in which acute alcoholic excitation seems to directly, after a certain quantity of poison has been taken, set up epileptic seizures (these seizures appearing only after the ingestion of alcohol), in which cases no epileptic attacks or tendencies are ever observed so long as alcohol is not drunk. Purely hysterical paroxysms are also excited in some cases by the consumption of even small doses. Some of the subjects so apt to be toxically affected in this way never display hysterical symptoms at other times.

Etiology.—Though the toxic action of alcohol in the causation of alcoholic intoxication is the same in kind, all kinds of alcohols being poisonous, the toxic action is modified, in a minor degree (1) by the variety of the alcohol; (2) by the idiosyncrasy of the drinker. The heavier and less highly rectified spirits (anlylic and butylic) are more toxic than the lighter (ethylic and methylic). Spirits are more acutely toxic than equal quantities of wines and beers, from the greater concentration and quantity of the alcohol in the former, tending more intensely to acute congestion and irritation of the gastric mucous membrane, the liver, kidney, heart, and brain. Absinthe induces epileptic convulsions; and methylism is much more rapid in its course

than ethylic alcohol. The temperament and constitution of the drinker also occasion some difference of symptoms, one subject getting drunk at once "in the legs," another "in the tongue."

> Drinking habits existed in one or both parents in all of 350 cases examined excepting 10. The father was usually the drinker. In another series of 210 cases the percentage was much lower: 25 per cent. gave a negative hereditary history. Mechanics, artisans, and small tradesmen furnish the greatest proportion of cases, the in-door workman being oftenest the victim. About one-third of inebriates are women. C. L. Dana (Med. Record, July 27, 1901).

> It is necessary to distinguish two opposed types of drinking, namely: the drinking associated with conditions of relative luxury (convivial drinking), and the drinking associated with conditions of relative misery, the result of bad industrial circumstances. Convivial drinking often leads to drunkenness, but does not tend very much to chronic alcoholism. Industrial drinking, while leading also, though less immediately, to drunkenness, tends rapidly and fatally to chronic intoxication. From a statistical point of view, while chronic alcoholism always implies the existence of drunkenness, the latter by no means implies the existence of chronic alcoholism. In England this divergence is best seen in the prosperous mining districts, which by reason of their prosperity are at once more drunken, but less alcoholic, than any other part of the country. The graver social evils that are in any important degree caused by alcohol are related to the chronic intoxication, and are, therefore, mainly due to industrial drinking. While educational, religious, and similar influences can control the excesses of convivial drinking, they have but little action on industrial alcoholism, which can only be checked by raising the standard of living. W. C. Sullivan (Jour. of Mental Sci., July, 1904).

Pathology. Post-mortem Appearances.—In a fatal case seen by me, of a married woman, aged 41, who had died without recovering consciousness in 5 1/4 hours after swallowing at a draught 2 3/4 pints of whisky, the face was pale, the eyes suffused and dull with dilated pupils, the temperature 91° F.; the pulse was thin, compressible, and barely perceptible; the breathing stertorous, the skin cold and clammy. There are sometimes also congestion of the liver, cerebral congestion with ventricular serous effusion, and distension of right heart-cavities with semifluid blood. In another case, that of a man who was found dead after a drinking-bout, the mucous membrane of the stomach was so inflamed and angry, with patches of a deeper hue extending over the pyloric surface to the duodenum, and a grumous, slightly muco-purulent exudation from bleeding-points, that arsenical poisoning was suspected. Tardieu in one case found pulmonary apoplectic extravasations of blood.

The first pathological stage of intoxication is one of vascular relaxation, with vasomotor paralysis and reduced inhibition; the second, one of continued inhibitory reduction, with incomplete partial paralysis of the brain- and nerve-centres, with intellectual automatism, accompanied by loss of co-ordination. The third stage is one of advanced paralysis, for the moment complete, with automatic existence and the reduction of temperature by three to seven or more degrees.

> Poisoning with alcohol in considerable doses, continued over a moderate time, will produce decided and ascertainable lesions of the nutrient structures and nervous elements of the cerebrum, very similar in character to the pathological lesions produced by other more virulent soluble poisons. Henry J. Berkley (Johns Hopkins Hosp. Reports, vol. vi, '97).

Differential Diagnosis. — In the first two stages, the exhilarative and the preliminary automatic, simple nerve excitement, opiate or other narcotic excitation, and apoplexy may simulate the symptoms of alcoholic intoxication; but the non-alcoholic rapidly subside, the apoplectic either passing off or going on quickly to coma. Usually the history or the surroundings reveal the presence of alcohol.

In the last, or third, stage of alcoholic insensibility the difficulties are much greater. The breath may smell of liquor, but that alone is not a safe guide; I have known abstainers taken to a police-cell, owing to some by-stander having poured brandy down the throat of the unconscious nephalist. Apart from a history of drinking, only withdrawal of alcohol from the stomach can prove an alcoholic origin. It has been asserted that pressure on the supra-orbital notches, thereby compressing the nerve, will elicit signs of life in the alcoholized.

Coma.—The comatose state of diabetes and albuminuria (in uræmia there may be albuminuric retinitis with normal or enlarged pupils) may be differentiated by a urinary analysis, though it must be remembered that both of these conditions may exist with alcoholism, and also with the odor of acetone from the breath. The renewal of the alcoholic symptoms by inhalation of the vapor of ammonia has been suggested by Waters.

Opium or Belladonna Poisoning.—From opium poisoning, pin-point pupils, and from belladonna poisoning, the equal dilation of the pupils usually exclude alcoholism, but alcohol may be present with either of the other poisons. Sometimes the greatly lowered temperature points to alcoholism.

Apoplexy.—The respiration is usually stertorous and the coma deeper. Hemiplegia may be evident from the greater flaccidity of the limbs on one side. The urine may contain albumin; auscultation may reveal some cardiac lesion; the breath will not smell of alcohol, *unless* the attack has occurred in a person who has been drinking, or some one, since the attack, has administered some alcoholic stimulant. Conjugate deviation of the eyes may exist.

Epilepsy.—In this disease there is a history of clonic convulsions. The pulse is rapid, dicrotic (Trousseau), and rather fast; frequently the urine and fæces have escaped, while the tongue may have been bitten.

The frequent mistakes in diagnosis committed by medical experts have demonstrated the practically insuperable difficulty in forming an accurate judgment till time be given for the disappearance of alcoholic symptoms. "For a time it may be impossible to determine whether the condition is due to uræmia, profound alcoholism, or hæmorrhage into the pons Varolii."

> Diagnosis between acute alcoholism and traumatism: external injury suggests the possibility of grave internal lesion. However, no mark of violence may be found upon the closest inspection; a fracture of the skull or a hæmorrhage within the cranium may have no outward sign. Or a heavy wagon may pass over the body, fracturing the ribs, rupturing the liver, perforating the intestines, or injuring other vital organs without producing any external mark. (See Abdomen, Contusions.) Primary shock, following immediately upon the injury, will exhibit a subnormal temperature and a small and fluttering pulse, nausea, vomiting, cold and clammy skin, and relaxed sphincters.
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> Depressed fractures at the vertex may be detected by palpation. Fissured fractures may be found upon inspection, with the help of an incision if necessary, or the finger-nail or a probe may be passed

across the surface. When the blood is wiped from a suspected part and no fresh blood appears, there is a suture; if fresh blood oozes to the surface, there is a fissured fracture. In fracture of the base there will usually be found hæmorrhage from the nose, mouth, and ears, and ecchymosis into the conjunctiva or subcutaneous cellular tissue; or vomited blood may have been swallowed after fracture of the ethmoid or sphenoid, followed by hæmorrhage into the posterior nares. But absence of such hæmorrhage does not necessarily indicate absence of fracture.

A rare, but positive, symptom of fracture of the base is the escape of a watery fluid, probably cerebro-spinal fluid, from the ears, the nose, or the mouth. Fractures of the petrous portion of the temporal bone involving the tympanum may produce in the temporal or mastoid region a pneumatocele: a smooth, circumscribed, resonant, non-fluctuating tumor.

Cerebral irritation usually follows a blow upon the forehead or the temple. The patient lies on one side, is restless, with the extremities flexed and the eyelids firmly closed. If the eyelids are forcibly opened, the pupils are found contracted and intolerant of light. The surface is pale and cool, or even cold. The pulse is small, feeble, and slow. The patient is irritable, muttering, and grinds his teeth when disturbed. The sphincters are not usually affected and there is no stertor.

There will be a rise in temperature in head injuries, except in primary shock and in large uncomplicated hæmorrhage, when the temperature is likely to be subnormal (Phelps). Other signs of intracranial lesion are photophobia, with the eyelids firmly closed, intolerance of sound, the carotids beating forcibly, a blowing of the lips, a flapping of the cheeks, rigid contraction of limbs, and clonic or tetanic convulsions. The Cheyne-Stokes respiration is found in injury to the brain and cerebral hæmorrhage. The breathing becomes, by degrees, deeper and more rapid up to a certain point, and then subsides in the same gradual manner until there is a complete cessation of respiration, with a deep silence, the pause before the next respiration lasting a variable time.

Unilateral phenomena point to intracranial lesions; for instance, unequal pupils or ptosis of one eyelid or drooping of one corner of the mouth. There may also be found in the radial pulse a want of symmetry in fullness and strength upon the two sides of the body.

In a suspected case the patient should be kept under observation until the effects of a debauch have worn off; symptoms of head injury, which may have been masked by the acute alcoholism, may then become manifest. John B. Huber (Med. Record, Feb. 20, '97).

Quinquaud's sign of alcoholism: The patient is to separate the fingers and rest them firmly across the observer's hand at right angles. For the first two or three seconds nothing unusual is noted, but then follow slight blows as if the bones of each finger were thrown back suddenly, the one upon the other, and struck the palm. The crepitations vary in character according to the individual; sometimes a slight rubbing and again a true crackling, which resembles that of a joint affected with dry arthritis. The pressure on the observer's hand should be moderate. In 52 epileptic women this sign was obtained but once: *i.e.*, in a woman who had been committed many times for drunkenness. M. B. Damon (Northwestern Lancet, July 15, 1901).

Treatment. — External heat should be applied, especially to the abdomen and feet; the room should be heated; the stomach should be emptied and washed out with warm or tepid water. No alcohol is to be given, but warm milk; if emesis occur, milk with soda or lime-water, barley-water, or rice-water; if there is collapse cinnamon (or ammonia in small doses) may be added to the milk, or cardamoms, cinnamon, and ginger in warm water. Chloroform, given with care, has been recommended against convulsions.

In slight cases, an emetic and warmth. Ipecac or an hypodermic injection of $^1/_{10}$ grain of apomorphine may be used to produce emesis.

Ammonium carbonate has been used with great success in doses of 1 drachm dissolved in water. It acts as an emetic and antidepressant.

The patient should be deprived of alcohol, confined in bed, and then given blue pill, followed by a saline cathartic. Insomnia should be met by the wet pack. Strychnine nitrate, $^1/_{32}$ to $^1/_{60}$ grain, should then be administered and nutrition supported by water, milk, koumiss, broths, soups, meat-juice, raw eggs, arrowroot, fruits, etc. When required, bromide and chloral or duboisine is ordered. Peterson (Jour. Amer. Med. Assoc., Apr. 15, '93).

In acute alcoholism apomorphine hydrochloride does in minutes what bromides and chloral do in hours. It is far superior to morphine, as it eliminates the poison, while morphine dries up the secretions. Injected hypodermically $^1/_{10}$ grain of apomorphine hydrochloride caused free emesis in four minutes; rigidity changed to relaxation, and excitement to sleep. Tompkins (Merck's Archives; Can. Pract., Dec., '99).

In study of carefully kept records of 10 hospital cases and personal experience in the use of digitalis in 6 cases the following personal conclusions are offered: 1. The indiscriminate use of large doses (half an ounce) of digitalis in acute alcoholism is fraught with danger. 2. The kind of cases in which it should be given are the strong, robust patients in early life, suffering from no complications, and with violent delirium. In these cases the result will be exceptionally favorable. They become quiet, go to sleep with a certainty and promptness that is not obtained by other methods. 3. If after three doses no narcotic effect is noted a continuance is not advised. In the above class of cases it can be used with perfect safety for a limited number of doses. 4. The failures in personal cases were in chronic alcoholic subjects, in middle and advanced life, in anæmic individuals with bad nutrition. 5. One fact noted in the cases which showed marked results from the treatment was that when they recovered and awoke from their sleep they were in such good condition that they were able to leave the hospital at once. This is an unusual experience, as ordinarily convalescence is delayed for two or three days. H. P. Loomis (Med. News, Aug. 18, 1900).

Many deaths ascribed to acute alcoholism are really due to acute nephritis, but usually to an acute exacerbation of chronic alcoholic nephritis, as acute nephritis, following an alcoholic debauch, in previously normal kidneys, is extremely rare.

If drunkards were taken to a hospital instead of to a jail, were put into a warm bed, then catheterized, and an examination of the urine made at once, the latter would often be found loaded with albumin, urea, blood-casts, uric acid, and epithelium: a condition which, if allowed to continue, soon results in uræmic coma and death. Many cases treated by means of active purgation, diuresis, diaphoresis, and active cupping would be restored to normal health. N. B. Ormsby (Cleveland Med. Gaz., No. 4, 1901).

Acute Alcoholic Delirium (Delirium Tremens).—This disorder chiefly occurs in habitual drinkers; but it is also observed in ordinary temperate persons after a prolonged drinking-spell. Though mostly met with in spirit-drinkers, it is seen occasionally in beer-, wine-, and cider- drinkers.

Symptoms. — There are two forms,—the traumatic and the idiopathic. They differ little except in the prodromata. In the traumatic form, after an accident (sometimes a slight traumatism) the characteristic tremors, etc., appear frequently without warning; but, in the idiopathic form, the patient who is about to have an attack is restless, uneasy, irritable, sleeps badly if at all, suffers from digestive troubles, and has little desire for food. Delirium then appears. The

patient cannot rest, but must be in constant motion. He is shaking all over ("the shakes"), is consumed with terrors, continually in deadly fright of things which he mentally sees, or of persons whom he thinks are after him for the commission of some crime. At other times his dread is of something terrible, though he cannot tell what it is. He is all the while trying to escape from these well-defined or undefined horrors, and, in attempting to escape, fatalities sometimes occur. Hallucinations of sight are most common: snakes, rats, mice, loathsome things, flames, and, in a case of the writer's, roaring lions bounding down the chimney, below the chairs, and rushing in at the windows. The delirium is best described as one of busy wakefulness and suspicion. There is a third non-febrile innocent form, in which the temperature does not rise above 100° F.

Visions of animals are present in 40 per cent. of cases at most. Such patients cannot estimate distances. Liepmann (Berliner klin. Woch., Apr. 8, '95).

Visions cannot be attributed solely to suppression of the influence of the light. Conclusion then reached that in those cases in which external excitations do not provoke the visions these are due to internal mechanical excitations upon the retina. The increase of the intra-ocular pressure due to the contraction of the extrinsic and intrinsic muscles of the eye, produced when the eye is fixed upon anything, may be so considered.

The inner imaginations of delirious alcoholic patients do not refer with a strange predilection to certain animals or to scenes of anguish or fright. Their character rather is decided by the nature of the peripheral excitation than by an anterior tendency given to the mind. If manifestations of anguish and the appearance of certain animals predominate in spontaneous visions, the cause should be sought for outside of the patient.

The author looks upon his method as to the study of sensorial illusions in alcoholic patients as superior to simple observation or questioning. H. Liepmann (Archiv f. Psych., vol. xxvii, p. 172, '96).

Hallucinations of hearing are not so common, but exist in probably 10 to 20 per cent. of cases. Delusions (false perceptions concerning self) are found in from 5 to 9 per cent., mostly delusions of persecution. Sometimes there is one hallucination, illusion, or delusion throughout, sometimes there is a succession.

Case of an army-engineer, a chronic inebriate, in whom delirium of grandeur and self-satisfaction, with intense ambitions to attain political prominence, came on in a few hours, after a long period of drinking. Subsidence when spirits were withdrawn and recurrence on the resumption of spirits. Editorial (Quarterly Jour. of Inebriety, July, '97).

The tongue is white and furred. Tremor of this organ, and especially of the muscles, is a more or less marked, but generally present, symptom.

The fever is not very high, being about 100° to 103° F. If higher, it is an unfavorable omen. The pulse is soft, rapid, and readily compressed. The skin is clammy. Insomnia is constantly present; but usually sleep and improvement occur on the third or fourth day. In unfavorable cases the patient grows gradually worse and dies of heart-failure.

Diagnosis.—Acute alcoholism may be mistaken for the delirium of meningitis, of typhus and typhoid fevers, and of chronic alcoholism. The history and progress of the case determine the first two, and the absence or significance of thirst, tongue trembling, and tremors the third.

Pulmonary disorders; congestion, especially when of traumatic origin; and pneumonia may also give rise to delir-

ium simulating that of delirium tremens. Fractured ribs may thus become the primary factor of violent accesses. The same may be said of erysipelas.

Pathology. — Acute alcoholism is due to gradually produced changes in the nerve-tissues, and especially to retained products of metabolism. The cerebral lesions in alcoholic delirium are of two varieties. The first is observed in all alcoholics, and is due to the alcohol itself: atheromatous degeneration of the vessels, the degree of disorder increasing as the calibre of the vessel is reduced. The nerve-cells also show granular pigmentation and fatty degeneration.

The second variety is derived specially from the character of the delirium, and not from the alcohol itself. It consists in congestion, hæmatic pigmentation in the capillaries and nerve-elements, and degeneration of the nerves and fibres of the cortex, the precursors of general paralysis.

Peddie's view, propounded a quarter of a century ago, that acute alcoholism is really poisoning from the accumulated effects of alcohol on a nervous and irritable temperament, has much in its favor.

Delirium tremens occurs when a brain, deteriorated by chronic alcoholism, is influenced by a toxic agent, either due to the action of bacteria or to autointoxication from diseases of the digestive tract, the kidneys, or the liver. The therapeutic treatment is quite incapable of abbreviating the duration of the disease; the critical sleep cannot be induced by any drug. Jacobson (Hospitalstidende, p. 143, '97).

Microscopical examination of the central nervous system and spinal ganglia of seven cases of delirium tremens. The changes were quite uniform, and consisted essentially, first, in thickening of the walls of the arteries, proliferation of the connective tissue in the media, and dilatation and infiltration of the lymph-spaces. These changes were more pronounced in the cortex, and frequently led to minute hæmorrhages, as many as two hundred of these having been counted in a square centimetre of the cortex. The capillaries appeared to be proliferated, particularly in one case, but they and the veins showed no pronounced anatomical alteration. The neuroglia-fibres of the cortex showed, according to Weigert's new method, considerable proliferation. The Weigert cells were more numerous than normal. The free nuclei, both the small and large varieties, were increased in number in the second and sixth layer of the cortex, and appeared to be accumulated around the degenerating cells. The spinal cord was apparently normal. There was no degeneration of the fibres in the spinal cord, but the tangential fibres of the cortex were somewhat thinned. The changes in the cells were, as is usual in such cases, limited to certain cells, and not uniform. In the spinal ganglia, the cells stained less distinctly. The nucleus was contracted, and in the end its membrane appeared to have become dissolved; the nucleolus showed a curious angular deformity. The cells of the anterior cornua showed in the lumbar region central chromatolysis without staining of the ground-substance, and an increase in size and decrease in part of the chromaphilic bodies, with alterations in the nuclei. In some cases vacuolation of the cells had occurred. The cells of Purkinje showed slight change or no alterations. The pyramidal cells of the cortex were usually degenerated, showing contraction, alteration of the nucleus, and alterations in the ground-substance. The giant pyramidal cells of the paracentral lobule were nearly all diseased. In general, it was noted that the parietal and occiptal regions were less affected than the others. Tromner (Archiv f. Psychiatrie, B. 31, H. 3, '99).

Brain-cells in 10 cases of acute alcoholism studied, the brains being investigated by the Nissl method of staining with methyl-violet: (*a*) patients who died of alcoholism with all the symptoms of meningitis showed on necropsy simple

congestion of the membranes (pia arachnoid), with some œdema in its texture; (*b*) microscopical examination rarely showed any migration of leucocytes or anything approaching encephalitis; (*c*) the larger (pyramidal and giant) nerve-cells showed pigmentation to an intense degree, the pigment being diffused through the cell-body; (*d*) the cytoplasm showing various degrees of degeneration (fatty and granular); (*e*) the cell-body generally was shrunk, and the nucleus partially so; (*f*) pericellular nuclei had proliferated, and were freely present in the pericellular sacs. In cases where death was due to exhaustion the shrinkage of cells was marked. Dana (Quart. Jour. of Inebriety, Jan., '99).

Etiology. — Acute alcoholism may be due to a temporary exacerbation during continuous alcoholic intoxication,—the idiopathic form; or to an accident, sudden shock, or an acute inflammation, especially pneumonia,—the traumatic form.

Study of 247 recovered personal cases of delirium tremens. Of these cases 202 were uncomplicated and 45 complicated by other diseases. Although the delirium tremens cannot be regarded as caused by the action of the pneumococcus, it resembles, in all features, an infectious disease: it has a stage of incubation,—a duration of about four days; it ends with a critical sleep; is accompanied by rise of temperature and almost in all cases by albuminuria; and when autopsy is made the spleen is generally found to be the seat of parenchymatous degeneration, as well as the heart, the kidneys, and the liver. Jacobson (Hospitalstidende, p. 143, '97).

Analysis of the material of the Moscow clinic as regards the statistics of alcoholic delirium. Only cases of chronic alcoholic delirium in which the presence of insanity of any other type could be excluded were included. Out of 4813 insane registered in the clinic since its opening, it was found that there were 33 cases of chronic alcoholic delirium. Of these, 30 were in men and 3 in women. Of 29 cases in which the heredity was noted, 20 showed alcoholism in the parents, principally in the father; three patients showed nervous or mental diseases in the immediate family. Heredity was therefore present in 96.55 per cent., and these figures, according to the author, showed conclusively enough the hereditary nature of chronic alcoholism. So far as the small number of cases observed warrants a conclusion, chronic alcoholic delirium develops much later in life in women than in men, and this because women begin to abuse liquor much later than men. Soukhanoff and Vvedenski (Roussky Vratch, July 12, 1903).

Prognosis. — In private practice the prognosis is favorable in ordinary cases; in hospital practice it is much less so. Of 1241 cases admitted to the Philadelphia Hospital during a fixed period, 121 died. Recurrence occurs if drinking is continued.

[I have noted recurrence from one to five times in 104 out of 442 cases treated in a special institution. NORMAN KERR.]

Treatment. — The patient must be kept in bed and carefully watched. Strapping in bed should not be practiced, as the restraint causes muscular movements and delirium. A sheet tied across the bed is preferable, as this allows more freedom of motion. Attendants or a padded room is best of all. No alcohol should be given, the strength being sustained by foods, milk, soups, etc.

Experience based on 2012 cases of alcoholism warrants the statement that alcohol in any form or quantity is injurious, and that its absolute and immediate withdrawal is important. Latimer (Boston Med. and Surg. Jour., June 16, '92).

If the delirium comes on abruptly, the exciting causes are acute and point to the formation of toxins. If the delirium has been preceded by mental

changes, and transient alterations of thought and conduct occur, gradually becoming constant and fixed, there are indications of organic lesions of the brain. It is important to ascertain whether the delirium follows from a long period of continuous drinking or whether the drink was preceded by some physical or mental disturbance arising from organic disease, traumatism, or mental strain. T. D. Crothers (Med. Record, Dec. 14, 1901).

Potassium bromide, $^1/_2$ drachm, with tincture of capsicum, given every three hours, is recommended for mild cases by Osler.

Sleep should be procured, and the strength supported. As an hypnotic, chloral may be given if the heart be not weak.

In alcoholic delirium the real chance of recovery lies in sleep. The patient is therefore isolated in a quiet, dark, and, if necessary, padded room, no physical restraint being employed. To procure sleep the patient is given 1 to $1^1/_2$ drachms of chloral-hydrate, with $^1/_2$ grain of hydrochlorate of morphine, in an infusion of limes. If sleep does not come on in about ten minutes, from $^1/_6$ to $^1/_4$ grain of morphine is injected hypodermically. After the alcoholic disturbance has subsided strychnine or nux vomica is given, followed by hydrotherapeutic measures. If there should be gastric complication, an antacid, such as sodium bicarbonate, is administered. Lancereaux (Bull. Gén. de Thér., Feb. 15, '93).

In the young, with elastic arteries and sound kidneys, opium can be given freely. In older patients, where the vessels are not in such good condition, chloral is less dangerous than opium. A. Guépin (Gaz. Méd. de Paris, Feb. 10, '94).

The heroic doses of these narcotics, with the cardiac depression apt to follow their exhibition, call for deliberation in their administration to aged and infirm inebriates, and I prefer, as an hypnotic, a simple febrifuge frequently repeated, such as repeated doses of liquor ammoniæ acetatis. Sleep, thus quietly and safely induced, has proved much more curative than the sleep for which the author formerly resorted to narcotics.

Twenty-five cases of alcoholic delirium in which trional was used with advantage. Conclusions: 1. Delirium was controlled with greater rapidity and safety by trional than by other hypnotics. 2. In the majority of cases a marked stimulant effect was observed, possibly on account of the methylic and ethylic elements which enter into the composition of the drug. 3. On account of the low temperature noted in all cases, trional must possess antipyretic properties, thereby simulating its allies of the phenol group. 4. It was always well borne by the stomach, and in one case was rapidly absorbed when administered per rectum. 5. No unpleasant after-effects observed. Bellamy (N. Y. Med. Jour., July 21, '94).

Trional of great value in insomnia. Morphine or opium retards the action of trional. C. H. Springer (Med. and Surg. Reporter, Sept. 22, '94).

A very hot bath gradually cooled and trional, 20 grains, in water containing 10 minims of tincture of capsicum recommended. If in thirty minutes there is no abatement, 10 more grains of trional are given. Forced feeding: milk, eggs, soups, etc. Bellamy (N. Y. Med. Jour., vol. lx, p. 72, '94).

In all cases of acute mania, or delirium tremens, the use of hyoscyamine, or the alkaloid hyoscyine hydrobromate, in large doses is recommended. I. A. Marshall (Med. Brief, Jan., '98).

A harmless remedy that will produce sleep in a few minutes, even when the patient is suffering with the wildest delirium, is apomorphine. Just enough is injected subcutaneously to produce light nausea, but not enough to cause vomiting. One-thirtieth grain is the average quantity required, but individual susceptibility greatly varies. In a few minutes after administering the remedy

perspiration appears and the patient voluntarily lies down, when a sound and restful sleep immediately follows. This sleep lasts at least an hour or two, and, if other sedatives are previously given, it will last six or eight hours. It is of special value in all forms of mania, regardless of the cause. It may also be given in full emetic doses in many cases of alcoholism with marked benefit. It seems to frequently act as almost a specific in relieving the alcoholic craving. Charles J. Douglass (N. Y. Med. Jour., Oct. 28, '99).

In delirium tremens the patient should be put to sleep with apomorphine, which can be done in a few minutes without danger and without emesis. He should not be restrained by physical force, and allowed alcohol in some form. He should be nourished with milk, eggnog, or some other liquid and easily assimilable food. C. J. Douglass (N. Y. Med. Jour., Nov. 17, 1900).

Opium, if given, should be administered cautiously, in the form of morphine, hypodermically. If, after three or four $^1/_4$-grain doses, the patient is still restless, no more is to be given.

If fever is present, cold douche, bath, or preferably the wet pack may be tried. If the pulse becomes too rapid and weak cinnamon, with very small doses of digitalis in aromatic spirits of ammonia, should be given. Digitalis in large doses is dangerous. (Osler, Delpeuch, Kerr.)

Cold baths in febrile delirium tremens at 18° C., or tempered according to individual cases, induce rapid resolution of symptoms. The infection and autointoxication are directly antagonized. Well-marked cardiovascular disease is a contra-indication. Salvant (Thèse de Paris, 1901).

The patient should be carefully fed, milk and concentrated broths being especially useful. If necessary, nutrient enemata are to be administered.

If the delirium occurs during an acute malady or following an injury, two indications must be attended to:—

1. Sustain the patient's strength by frequent assimilable nourishment.

2. Obtain sleep. For this purpose opium may be given at the outset in one full dose, or laudanum may be given by the rectum.

Chloral may be given in doses of $2\ ^1/_2$ to 3 drachms unless some cardiac or pulmonary complication or depression renders its use dangerous.

If the delirium appears without apparent cause, during chronic alcoholism or following recent excesses, the administration of alcohol as a remedy may become necessary. If the fever be not too high, the delirium too violent, and if the strength of the patient be preserved, it may be withheld; but, if the patient be adynamic, recourse must be had to alcohol, as well as to other diffusible stimulants: caffeine, subcutaneous injections of ether, or draughts of ammonium acetate. Any form of narcotics should be avoided in these cases. (Delpeuch.)

The intravenous infusion of saline solution in delirium tremens increases the amount of the circulating medium in which the toxic materials are dissolved, thereby diluting the poison and bathing the nerve-centers with a more attenuated solution of the same. The amount of circulating fluid is increased above the normal, so that the excretion of fluids through all the fluid-excreting channels is increased, thereby carrying off in solution much of the contained toxins. The action of the heart is improved by the filling of the relaxed vessels. These suffice to restore the physiological equilibrium and turn the balance in the favor of recovery. J. P. Warbasse (Med. News, Mar. 2, 1901).

During the past eight years the writer has invariably treated his cases of delirium by the subcutaneous injection of saline solution, and his clinical experience of this method has convinced him of its superiority over other plans of treatment. All depressing narcotics, such as opium, morphine, and chloral,

should be rejected, and the only addition to the injections of artificial serum should, in cases of cardiac weakness, be an occasional injection of sulphate of strychnine. Quenu (Bull. et Mem. de la Soc. de Chirurgie de Paris, No. 18, 1905).

Acute Alcoholic Mania (Mania a Potu).

Symptoms.—The patient, in wild, ungovernable fury, shouts, stamps, strikes, or kicks, and is, for the moment, uncontrollable. The eyes roll, the face is flushed, and the veins distended and engorged; the muscles are at their highest point of tension and are in continuous violent action. The pulse is strong, bounding, and tumultuous. Though mechanically conscious, the subject is filled with "blind fury." He is carried away in a tempest of nervous excitation and passion. The paroxysms of violence sometimes last only a few minutes, at other times for from an hour to several days with quiet intermissions. Rarely are there delusions, though the infuriated subject may vent his violence on the first animate or inanimate object in his way. In a few cases the fury is directed against a certain person or thing. Violence is succeeded by calm; a few minutes after a storm the temperature is normal, and during the paroxysm rarely raised. In some constitutions a paroxysm may be provoked by a small quantity of alcohol.

Differential Diagnosis. — It may be differentiated from delirium tremens by the absence of tremors, terror, hallucinations, delusions, the white tongue, nausea, and the delirium of the latter. Further, mania a potu may arise from a small quantity of an intoxicant taken in a short time, while delirium tremens is due to large quantities taken in rapid succession, or from smaller quantities long continued.

Etiology and Pathology. — Alcoholic mania is occasionally seen in chronic inebriates, and most frequently in periodic tipplers. In the latter it often occurs when, soon after an interval of abstinence, an intoxicant is freely partaken of. Some chronic inebriates invariably suffer acute mania if they drink a single glass of spirits, wine, or beer beyond their usual allowance. The paroxysms of acute mania resemble those of epilepsy, and a large proportion of police-court drunken offenders are patients of this class. The symptoms are evoked by the pathological action of acute poisoning by alcohol, in nervous systems liable to such excitation, either congenitally or from the effects of intemperance, traumatism, or brain-tire.

> The forms of insanity met with which result from alcoholism are: (1) amnesic, (2) delusional, and (3) chronic varieties which end in dementia. The best working hypothesis for the prevention and cure of all forms of alcoholic disorders, whether mental or physical, must be based upon the practice of total abstinence. R. Jones (Lancet, Oct. 25, 1902).

Prognosis. — The prognosis is much more favorable than in acute mania, the paroxysm usually rapidly passing away, leaving the patient exhausted and peaceful. Rarely is there relapse unless alcohol be again taken.

Treatment. — Little treatment is generally needed. Non-alcoholic liquids, such as milk, iced milk, milk and soda, or saline draughts with ipecacuanha and small doses of the bromides are sufficient to bring about recovery. Sometimes cold affusions and, in prolonged paroxysms, wet packs prove valuable adjuncts.

When violent mania is present, apomorphine, $^1/_8$ to $^1/_6$ grain, hypodermically, causes nausea and vomiting and rapid removal of the violent symptoms.

Study of 958 cases of alcoholism, of which 40 suffered from acute excitement, or mania a potu.

No stimulants given in any case. The uniform prescription was 30 grains of bromide of potassium every two hours in maniacal cases, and every three or four hours in other cases. In cases of noisy mania, 1/4 grain of morphine sulphate was occasionally given hypodermically at bed-time. All the cases recovered. Latimer (Johns Hopkins Hosp. Bulletin, No. 119, '91).

Chronic Alcoholism.

Symptoms. — The intensity of the symptoms corresponds with that of the functional and organic disorders produced. In average cases the earlier symptoms are those indicating nervous disorder, the most important being muscular tremor. The hands are unsteady and shake; but, in the majority of carefully examined cases, the lower limbs are found to be affected before the upper (particularly in females). The trouble is especially marked in the morning, and may be such as to render the use of the limbs difficult. At first an effort of the will enables the patient to control the movements of his hands and feet, but this power gradually wanes.

Restlessness, the limbs starting involuntarily, especially after retiring, is the first indication of impending trouble in some tipplers. The mind becomes irritable; there is headache, dizziness, tinnitus aurium and muscæ volitantes, while flashes of light are frequently complained of.

Besides the irritability there is usually mental disquietude, the patient being unable to settle down to his duties. He frequently labors under the apprehension that bodily harm is awaiting him, whether through the act of some enemy, an accident, or illness he cannot tell. In walking he experiences at times the sensation of falling down a precipice: a bad omen, according to Anstie. As the disease advances the chronic alcoholic is apt to become a prey to delusions of suspicion, while a prominent feature is what may be designated "narcomaniacal untruth," the confirmed sot asseverating that he has drunk no liquor even when seen in the act.

Pains around the limbs—especially at the wrists and ankles, the shoulders, along the muscles of the spine, and down the spine proper—are common. These pains are intermittent and paroxysmal, usually appearing late in the day or after prolonged exertion, according to the fatigue to which the patient has been exposed. These neurotic and muscular pains were at one time credited to rheumatism.

Besides the disorders of locomotion attending muscular inco-ordination, there may be impairment of sensation. The lower limbs are frequently found wasted, while the abdomen is found enlarged and, perhaps, pendulous, owing to the presence of adipose tissue. Epileptiform convulsions are occasionally observed, while mania, melancholia, and dementia are frequent sequelæ.

Gastric disorders may be present early in the history of the case. Nausea and vomiting are common; these usually occur in the morning, and have been known to extend to hæmatemesis and death.

The appetite is absent for the breakfast in almost all advanced cases; the tongue is coated, and the breath usually very foul. A sensation as if the stomach were sinking is a frequent symptom: an important one in that it usually prompts the patient to drink to obtain temporary relief.

The eyes are congested and watery, the features expressionless. The skin of the face is red and frequently papular: a

condition known as "acne rosacea" (*q. v.*). The latter disease does not occur only in drunkards, however, functional gastric and menstrual disorders being active as etiological factors in perfectly temperate people.

The chronic alcoholism of ardent spirits (whisky, brandy, and gin especially) has a distinguishing characteristic of emaciation with shrunken, though fiery or bluish, countenance, while that of malt intoxicants and sweetish wines (particularly if not alcoholically very strong) exhibits usually a generally bloated appearance, with adipose superabundance.

> Alcohol plays an enormous rôle in bringing about degeneration of the race. This is most clearly seen in the growing inability of mothers to nurse their offspring; thus, when mother and daughter of one family were not obliged to resort to artificial food, the father was a drunkard in only 2.6 per cent., while where both were unable to nurse, a history of excessive drinking was obtained in 42.2 per cent. All cases of functional derangement owing to imperfect condition of the nipples were ruled out. The condition is hereditary, for, if the mother has lost the power, it will never be regained in that particular degeneration. Other stigmata go hand in hand with deficient nursing capacity, and a pronounced disposition toward tuberculosis, nervous diseases, and psychoses is very evident. The offspring of alcoholics also suffer more frequently from carious teeth. G. v. Bunge (Virchow's Archiv, vol. clxxv, No. 2, 1904).

Differential Diagnosis.—In most cases the alcoholic history, with the symptoms, easily discriminate chronic alcoholism. Among the latter, especially morning nausea, or sickness; foul ethereal breath; furred tongue, eructations, gastralgia and gastrodynia, anorexia, and cephalalgia; diarrhœa or, more generally, constipation; tremors, restlessness, fear. In advanced stages bloated, puffy, or pinched features; shuffling, ataxic gait; listlessness, perverted sensations, and untruth. In alcoholically paralytic cases the paretic symptoms are antedated.

> Recently Quinquaud described the following symptom as characteristic for alcoholism: The fingers of the patient to be examined are spread out and then placed perpendicularly upon the palm of the physician. After several seconds a decided crepitation will be felt by the latter, if the test is positive, even where the joints are absolutely normal. The writer has investigated the symptom in a large number of cases, and concludes that the crepitation does not come from the joints, but results from slight lateral motions of the tendons in their sheaths, set up by the involuntary muscular contractions so common in alcoholics. The symptom is present to a slight extent also in normal individuals. M. Herz (Münch. med. Wochen., May 30, 1905).

Etiology. — Heredity has, by most authorities, been considered to be the chief predisposing influence. Crothers traced a family history of inebriety in one-half of his cases, besides 25 per cent. of defective brain-states from a neurotic or other morbid inheritance inclusive of insanity.

> [In over 3000 cases I have found fully one-half with an inebriate ancestry, in addition to 6 per cent. with a pedigree of mental disease. Almost the same proportions have been the experience of the American, Fort Hamilton, and the English Dalrymple Homes. Bevan Lewis attributed 64 per cent. to parental inebriety, some form of transmitted neurosis, or insanity. Piper, likewise, puts the proportion of hereditary to acquired cases at two to one. In my opinion, the number of cases in which an ancestral history of alcoholism has been traced is much below the actual amount, as it is frequently difficult to get relatives to admit the existence of an alcoholic taint. Norman Kerr.]

Heredity is said to be crossed when, in its single parental form, the children of the opposite sex to the inebriate parent only are affected. An important fact is that all these and other forms of alcoholic transmission may be handed down by a parent or parents who have never been known to have been intoxicated, or to have exhibited any uncontrollable impulse to intoxication.

> Neurotic intemperance possesses features which serve to distinguish it from the common vice of occasional and deliberate drunkenness. Whereas the *vice*, once so prevalent and even fashionable among the men of all classes, is now all but confined to what are called the lower orders, the *disease* is confined to no class, and to neither sex, and instead of diminishing seems decidedly on the increase. The occasional drunkard seeks companionship in his cups, and is generally more or less noisy and uproarious in his intoxication; but the victim of this disease inclines rather to shrink from observation, and is generally quiet and morose under the influence of alcohol. J. Strachan (Brit. Med. Jour., Oct. 1, '98).

> Careful study of four hundred alcoholics has been made during the last fifteen years at Zurich, under Forel's supervision, and again the fact of heredity is emphasized. Forty-three per cent. of the cases had one or both parents alcoholic, and 40 per cent. of the parents were wholesale or retail dealers in liquors. One hundred and thirty-two, out of three hundred and forty-six, had become alcoholics without drinking liquors, consuming merely beer, wine, or ciders. Alcoholism is most frequent between 20 and 60 (93.5 per cent.). Below that age a case is most sure to be direct heredity. All the cases showed various physical, mental, and moral alterations; degeneration of heart, arteriosclerosis, affections of the stomach, tremor, ataxia, pupillary troubles, general denutrition, etc. One-fifth were sexual perverts (hyperæsthesia, precocious debauchery, inversion). Fourteen per cent. were epileptics; in six cases the attacks followed alcoholic excess and disappeared entirely when the patients refrained from alcohol. Editorial (Quart. Jour. of Inebriety, Jan., '98).

Alcoholism and evil disposition, with criminal tendencies, are ascribable to heredity, according to Moreau. It has generally been found that the major portion of inherited alcoholism is due to the alcoholism of one or both parents.

> [This may be estimated at nearly two-thirds, after an examination of the records. Norman Kerr.]

The transmissibility of an alcoholic inheritance has been very generally admitted, among other writers by Plutarch, Aristotle, Darwin, Rush, Morel, Lancereaux, Grenier, Magnan, Day, Wright, Mason, Carpenter, Thompson, Richardson, Forel, and Demme.

Alcoholic heredity may be divided into single or double, mediate (parental) or immediate (grandparental, etc.), homogeneous (transmitted as alcoholism) or heterogeneous (transmitted as some other neurosis).

An innate tendency to alcoholic excess has been observed in children of tender years,—from two years old and onward, by Barlow, More-Madden, Langdown Down, Kerr, and others.

> Examination of two groups of 10 families each in a children's hospital. One group of 57 was affected, more or less, by alcohol; the other of 61 was unaffected, or slightly so. Of the first group 20 had inebriate fathers, the mothers and grandparents being moderate drinkers. Only 45 per cent. of these had healthy constitutions; 31 had inebriate fathers and grandfathers, but temperate mothers and grandmothers; only 2 of these, or a little over 6 per cent., were healthy. Of the 61 children belonging to temperate families, 82 per cent. were in good health. Demme (Brit. Med. Jour., Sept. 27, '90).
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> Among 819 descendants of 215 alcoholic families there were 121 premature

deaths, generally from convulsions, 38 cases of physical debility, 55 of tuberculosis, and 145 of mental derangement. Among the remainder were many cases of epilepsy, hysteria, idiocy, etc. Legrain (Med. Press and Circular, June 13, '94).

When double parental alcoholism is of sufficient duration to induce nerve-central organic disturbances, a weakly mind in the offspring is inevitable. Wilkins (N. Y. Med. Jour., Sept. 22, '94).

Large percentage of insane children in Germany due to habitual drinking. Alcohol produces *acquired* insanity by acting as exciting cause, and *hereditary* insanity by causing organic changes, which are transmitted to descendants. Habitual drinking is most detrimental to offspring. Rust (Med. Pioneer, Aug., '95).

The generative cells of drunkards alcoholized and their children are degenerates; their resisting-force against alcohol is thus diminished. Evolutionary adaptation of mankind to alcohol is impossible. Fürer (Le Bull. Méd., Aug. 25, '95).

Experimental dosing of hens' eggs with alcohol delays and modifies development, monstrosities and anomalies resulting. Fréré (Jour. de l'Anatomie et de la Physiologie Normales et Pathologiques de l'Homme et des Animaux, Mar., Apr., '95).

Report of 141 cases of idiocy, epilepsy, dementia, etc., directly traced to alcoholic parentage and demonstrating the alcoholo-neuropathic heredity of the drink-crave, the drink-habit, and the drink-vice, and *vice versâ*. Sollier (Alienist and Neurologist, Apr., '97).

Influence of maternal inebriety on the offspring. Series of cases of chronic drunkard women who have borne children were selected from the female population of Liverpool prison, among whom habitual inebriety had been very prevalent. Of 120 female inebriates whose histories were trustworthy there were born 600 children, of whom 265 (44.2 per cent.) lived over two years, while 335 children (55.8 per cent.) died when under two years of age, or were still-born. With a view to establishing comparisons with a healthy non-alcoholic standard, it was found that 21 of the women were able to give details regarding female relatives (sisters or daughters) of sober habits who had contracted marriages with sober males and had borne children. Thus, of sober mothers, 28 in number, there were born 133 children, of whom 33 (23.9 per cent.) died when under two years of age. Thus the death-rate among the children of the inebriate mothers was nearly two and a half times as great as that among the infants of sober women of the same stock.

The progressive death-rate in the alcoholic families when three or more children were born is shown in the following table:—

	Cases.	Dead and Still-born Per Cent.
First-born	80	33.7
Second born	80	50 0
Third-born	80	52.6
Fourth- and fifth-born	111	65.7
Sixth- to tenth-born	93	72.0

Of the children comprised in the series, 219 lived beyond infancy, and of these, 9, or 4.1 per cent., became epileptic: a proportion extremely high as compared with the frequency of epilepsy in the general mass of population, which, according to Bruce Thompson, is less than 1 per 1000. W. C. Sullivan (Jour. of Mental Science, July, '99).

Case of alcoholism in a boy, aged 30 days, whose nurse had given him 1¼ drachms of brandy daily. He vomited regularly after nursing and slept very soundly all night. After ceasing to give the brandy, the infant lost weight for two weeks, but then gained rapidly. Follet (Archives de Méd. des Enfants, Aug., 1902).

Chronic alcoholism diminishes the resistance of the organism, while acute alcoholism aggravates the infectious diseases and quickly causes death. Small doses of alcohol have no action upon disease, either one way or the other. Yet the fact remains, that after illness, alcohol in moderate amounts is an excellent rebuilding stimulant. Marcel Labbé (La Presse Méd., Aug. 16, 1902).

Sex. — The proportion of females as compared to that of males has, until recent years, probably been, on an average, about one woman to six men. But during the past fifteen years or so there has been an enormous increase of chronic alcoholism among females, especially in England, France, and the United States, though a considerable increase has been observed in other countries. The disease seems to be more inveterate in them than in males.

> Out of 500 patients treated in the outdoor department of the Laennec Hospital, in Paris, 156 were females presenting symptoms of chronic alcoholism. Grandmaison (British Med. Jour., Apr. 16, '97).
>
> In more than two hundred female inebriates, the author has not been able in any way to reform more than 10 per cent. of them, the results being less favorable than in the case of male drunkards. I. N. Quimby (Boston Med. and Surg. Jour., Oct. 28, '97).

Age. — As a rule, about one-half the whole number have occurred between 40 and 50, though there has been an increase in adolescent life, from 18 to 25, these younger chronic alcoholists specially developing an homicidal maniacal tendency (as noted by Magnan, in Paris). Even boys of 7 years and upward having been treated for delirium tremens and chronic alcoholism in England, and children are sometimes sent drunk to school in Austria.

> The use of alcohol by children is one cause of the depopulation of France. The conclusion reached is that it is as dangerous as is an excess of alcoholic beverages for an adult; for the adolescent they are deadly, because they cause organic changes, hinder physical development, and impair the normal faculties even to the extent of degeneracy. For these reasons, then, alcohol should be proscribed as drink for children. Lancereaux (Jour. des Praticiens, No. 42, p. 665, '96, second series).
>
> [I have known cases originating over 70 and even over 80. There is an inebriate climacteric, beyond which period nervous periodicity, energy, and function fail in response to alcoholic excitation, placed by Parrish at between 40 and 50, and by Kerr 15 years later in life, between 55 and 65. NORMAN KERR.]

Religion. — Brahmanism, Buddhism, and Mohammedanism predispose against alcoholism more than other religions.

Race.—Eastern peoples, generally, are more susceptible than Western to alcoholism. The latter (also some savage races), with their intenser energy, take to alcohol more impulsively and die sooner from it. The Jewish community possesses a striking racial inhibition which has largely contributed to their marked general freedom from alcoholism.

Atmospheric and telluric conditions predispose a substantial number of persons to alcoholism. The form of the alcoholism is to some extent modified by atmosphere and climate.

Education.—In civilized communities culture and refinement endow many individuals with a more delicate susceptibility to alcoholic poisoning.

Occupation. — Occupations with a depressant or exciting influence on the nervous system predispose to alcoholism.

Marital Relations. — Between single and married males there is little difference, but, in women, the proportion of spinsters is only one to from four to six married, widowed, or divorced women.

Temperament.—The nervous and sanguine temperaments are, by far, the most susceptible to alcoholic toxication; the phlegmatic rarely yielding.

Associated Habits.—Though the bulk of the subjects of alcoholism are smokers or users of tobacco in some form, the popular idea that tobacco-use largely predisposes to alcoholism seems to be without foundation.

[I have seen only a very few such instances. Only to a limited extent does any other narcotic, such as morphine or cocaine, act as a predisposing influence. NORMAN KERR.]

Diseases and Injuries. — In no inconsiderable number of cases syphilis predisposes to chronic alcoholism. Phthisis, gout, rheumatism, malarial poisoning, the neuroses, diabetes, and other ailments exert a similar influence. Injuries and sun-strokes, head-lesions, and heat-apoplexy often leave mental impairment and inability, which induce susceptibility to take on alcoholic narcotic disturbance and addiction.

An intelligent and educated woman never becomes a drunkard but from some deep-rooted and often carefully-concealed cause, which may be physical or mental. Lawson Tait (Brit. Med. Jour., Oct. 15, '92).

Diet.—Improper, defective, and badly-cooked food, with bad hygienic conditions, frequently act as predisposing factors. A considerable degree of alcoholic predisposition, in the person of the regular, limited drinker and his progeny, is the direct effect of chronic alcoholic poisoning. The gradual alcoholic paralysis of inhibition induces a lessened capacity to resist the narcotizing action of the alcohol.

Most of these influences operate also as causes exciting to intoxication. In addition, there are nerve-shock in both sexes, the functional crises of puberty, menstruation, pregnancy, maternity, lactation, and the menopause of women, monotonous dullness, and medical prescribing. Nerve-shock of some kind probably accounts for from a seventh to a sixth of chronic alcoholics.

[In my experience about 2 per cent. of cases have arisen from head injuries immediately after the excitation consequent thereon; and $^1/_2$ of 1 per cent. from alcoholic intoxicants medically prescribed. Alcoholic drinks and proprietary preparations containing alcohol are also taken or given as a "remedy" or "medicine" under non-medical advice, by nurses and other unqualified persons. NORMAN KERR.]

A common assertion is that doctors' prescriptions are one of the chief causes of drunkenness. In a study of the subject in over 3000 cases of inebriety I was unable to trace the initiation of the alcoholism as due to medical prescription in more than $^1/_2$ per cent.

Pathology.—*Protoplasm.*—The experiments of Dogiel, B. W. Richardson, and others indicate that alcohol, even in very small quantities, affects protoplasm, and therefore the entire system. It tends to cause cessation of the amœboid movements of the white blood-corpuscles, and, through this, increases the liability to suppuration and the sluggish reparative action observed in drunkards. Its general effect is to inhibit vital phenomena inherent in the protoplasm, hindering thereby the resistance of the body to infectious diseases, while the multiplication of various bacilli in the presence of even minute quantities of alcohol would seem to indicate that the life and growth of destructive elements are promoted. The blood is improperly aërated and waste material is unduly retained in the body.

The walls of cells inclosing germinal matter are dissolved, free albumin is coagulated, red globules are deprived of part of contents, leaving them shrunken; growth of tumors favored, metabolic action limited, organization of neurodynia of gray matter reduced or prevented. Wilkins (N. Y. Med. Jour., Sept. 22, '94).

Alcohol lessens the absorption of oxygen by the blood-corpuscles and the exhalation of carbonic dioxide. Every function of the body is thereby affected. Prout, Edward Smith, Harley, Schmiede-

berg, Vierordt, Kerr, and others (Med. Pioneer, Oct., '95).

The continual ingestion of alcohol causes atrophy of elementary organisms, tending to destroy cellular protoplasm and vitality. Gaule (Le Bull. Méd., Aug. 25, '95).

Alcoholized animals not only show the effects of inoculations earlier than do non-alcoholized rabbits, but, in the case of the streptococcic inoculations, the lesions produced are much more pronounced than are those that usually follow inoculation with this organism. A. C. Abbott (Jour. of Exper. Med., vol. i, No. 3, '96).

Cases showing marked inhibitory influence of alcoholism on the growth of children. Lancereaux (La Presse Méd., Oct. 14, '96).

Distinction made between the diffuse irregular spinal cord changes, caused by alcohol, and the more systematized processes. The diffuse changes consist in a thickening of the vessel-walls and increase in the connective tissue of the pia and of the cellular tissue surrounding the cord, hyaline degeneration of the small vessels, and a diffuse gliosis, which destroys the nerve-fibres. The changes are not different from those found in arterial sclerosis and marasmus. Commonly the changes are most marked in the posterior portions of the cord. The more symmetrical changes are found in the posterior column, with projections into the posterior roots, especially marked in the lumbar enlargement. This was frequently associated with changes in the peripheral nerves. The changes could not be distinguished from those of beginning tabes. E. A. Homen (Zeit. f. klin. Med., Bd. xlix, H. 1-4, 1903).

Stomach.—The interior of the stomach presents a dark bluish-red hue, sometimes looking very fiery and angry; while ulcerative erosive patches, thinning of muscular coat, with an increase of connective tissue and atrophy of gland-cells, are also conditions usually observed. In malt-liquor chronic alcoholists there is dilatation. The irritation of the gastric mucous membrane hinders digestion, and thereby interferes with the nutrition of the patient.

Autopsy of nineteen inebriates. Five showed inflammation of the stomach alone. In two of these the mucous membrane of the stomach was black and thickened, and in places ulceration had taken place. Of the other seven, three had suffered from both gastritis and enteritis, while the remaining four had suffered from extensive inflammation of some part of the intestinal canal, a majority of them suffering from colitis. A remarkable feature in these twelve gastro-intestinal cases was that everyone had, at some period of their lives, suffered from pleurisy or pleuro-pneumonia, for pleural adhesion existed in every case. Carpenter (Western Med. and Surg. Reporter, Jan., '91).

Digestion.—The irritation of the gastric mucous membrane hinders digestion. Alcohol impairs all the gastric functions, and thus interferes with the general nutrition.

Experiments on five young men: Alcohol used in a 25- and 50-per-cent. solution, of which $3^1/_2$ fluidounces were taken ten or twenty minutes before the patient's dinner (consisting of soup, cutlet, and bread). Conclusions: 1. During the first three hours after the ingestion, the gastric digestion is markedly retarded, and dependent upon a decrease in the proportion of hydrochloric acid. 2. The diminution is especially pronounced in persons non-habituated to the use of alcohol. 3. Stronger solutions of alcohol act more energetically than weaker ones. 4. During the fourth, fifth, and sixth hour after the meal the digestion becomes considerably more active, the proportion of hydrochloric acid markedly rising. 5. Under the influence of alcohol, the secretion of the gastric juice becomes more profuse and lasts longer than under normal conditions. 6. The motor and absorptive powers of the stomach, however, are markedly depressed, the decrease being directly proportionate to the strength of alcoholic solutions ingested. 7. Alcohol distinctly retards the passage of food from the stomach into the duo-

denum. 8. On the whole, alcohol manifests a decidedly unfavorable influence on the course of normal gastric digestion. Even when ingested in relatively small quantities, the substance tends to impair all gastric functions. 9. Hence, an habitual use of alcohol by healthy people cannot possibly be approved of from a physiological stand-point. Blumenau (Inaugural Dissertation, No. 17, p. 60, '90).

[Sir William Roberts's view, that we are, as a rule, suffering not from slow, but from too rapid, digestion, and that we therefore need alcohol, not to aid digestion, but to hinder it, can hardly be accepted. Clinical observations of performance of digestive function in living human subjects does not exhibit, as a rule, improved digestion after the administration of alcohol. NORMAN KERR, Assoc. Ed., Annual, '96.]

It would appear, from a study of many cases, that, so far, no general rule can be found, and each case must be studied from the facts of its history. Thus, in some cases, a meat diet is literally poisonous, and its removal is the first essential for a cure. Again, a grain or fruit diet is clearly injurious, and more rapid recovery follows a change. In all cases states of starvation and autointoxications exist the removal of which conditions may be of equal importance to that of alcohol. The study of the diet brings out many unsuspected causes which require removal and treatment before a cure can be effected. Editorial (Quarterly Journal of Inebriety, Oct., '97).

Liver. — The liver is frequently affected by one of the various forms of cirrhosis. The proclivity of each individual bears considerable influence upon the development of this disease, however. The other hepatic chronic disorders most apt to be encountered are fatty and nutmeg liver. Acute hepatitis is less frequently met with.

The lesions found in the acute form of alcoholic hepatitis are like those observed in infectious, suppurative hepatitis, showing the identity of effects between infectious and toxic processes. Pilliet (La Tribune Méd., Apr., '90).

The ascites of cirrhosis is habitually absent in connection with the cirrhotic alterations of the liver in the alcoholic insane. Klippel (Annales Médico-psychologiques, Sept., Oct., '94).

Case of acute alcoholism in which the hepatic functions were suppressed during twenty-one days. Cassaët (Le Bull. Méd., Oct. 31, '94).

Experimental alcoholism in animals causes preliminary gastric catarrh, then fatty degeneration of the liver. Koulbine (La Méd. Mod., Jan. 16, '95).

Histological examination, in two rabbits which were subjected to progressively increasing doses of wine. There were traces of an irritating influence upon the liver, which were found principally in the central parts of the lobes. The connective tissues of the portal spaces did not present lesions that were very clear, but the subhepatic veins and the capillaries were filled with leucocytes and proliferated endothelial cells. The glandular parenchyma was remarkable for the considerable size of its nuclei, which were vesicular; the cellular protoplasm seemed to be intact. One had died at the end of twenty days, without presenting any visceral alterations. The other had died after thirty days, and presented hæmorrhage of the stomach. The liver was of a pale-grayish color and the spleen was tumefied. Lancereaux (La Presse Méd., Oct. 14, '96).

With the above conditions is often associated a special facies, consisting in watery, blood-shot eyes, sometimes yellowish from bile, and in enlarged venules on the nose and cheeks; at times, acne rosacea.

At an early stage the eyes of chronic drunkards present the following symptoms: Catarrhal conjunctivitis, congestion of the iris, spasm of accommodation, contracted pupils, photophobia, nyctalopia, a glimmering sensation in bright light, scotomata, amblyopia, and partial atrophy of the optic nerve. (May.)

Pancreas and Intestines. — The interference presented by alcohol to the

proper digestion of fats is mainly responsible for the fatty degeneration of the heart and other organs generally encountered at autopsies. The pancreatic secretion being coagulated by the alcohol, the fat is not emulsified.

Although the coagulated secretion is redissolved into its former elements by pure water, it is impossible to restore it in the presence of alcohol, as there is a mixture of water and alcohol in which the secretion will not dissolve. The stearin of the fat is dissolved by the alcohol out of the fat-globules. This dissolution is probably aided by the duodenal secretions. The remainder of the fat becomes a foreign body in the circulation and, being a compound of palmitin and olein only, does not possess the property by virtue of which it is attracted to the adipose vesicle, but is deposited in the different tissues, cavities, and organs, thus constituting fatty degeneration. Wilkins (New York Med. Jour., Sept. 22, '94).

The intestinal tract bears the brunt of the irritating action of improperly digested food, and gastro-intestinal trouble is frequent, especially in children.

Many infants suffering from acute or subacute gastro-intestinal disease are the victims of unrestrained administration of whisky or brandy, no definite direction having been given as to dose. Henry Koplik (Med. Pioneer, Feb., '94).

The ingestion of alcohol causes migration of microbes from the intestines to the peritoneum and to the blood of the vena porta. Wurtz and Hudelo (Le Bull. Méd., Jan. 30, '95).

Kidneys. — The structural definition of the kidneys is frequently lost in advanced cases. Their functions are interfered with, and cumulation of products of metabolism is imposed upon the system. The various forms of nephritis are natural consequences of the irritation produced.

Uric-acid and calcium-oxalate crystals are found in the urine of persons in good health after taking alcoholic drink, besides an increased number of leucocytes with cylinders and cylindroids. It may, therefore, be concluded that, even in moderate quantities, alcohol irritates the kidneys, the augmented leucocytes, cylinders, and crystals being due either to the increased metabolism of the tissues or an alteration by alcohol of the relations of solubility of the urine salts. After a single indulgence this action lasts for thirty-six hours. But continuation is cumulative. Glaser (Quarterly Jour. of Inebriety, Apr., '92).

First and most frequent effect on kidneys is polyuria, then diabetes insipidus, followed by diabetes mellitus in predisposed alcoholics. Wilkins (N. Y. Med. Jour., Sept. 22, '94).

There is a true diabetes, in which an affection of the liver is found preceding by a long period the diabetes, and to which the diabetes is due. These patients have been considered until now as suffering merely from diabetes, and not from the liver, since an examination of the liver was necessary in order to recognize them as suffering from that organ. The alternate phases of amelioration or the contrary in the diabetes coincides with the development of the process in the liver; it may be recognized by the changes in the volume, form, density, and sensibility of the liver.

Of six cases seen by the author, there were three in which diabetes with hypertrophic liver had existed for years who suddenly developed a cirrhosis, while the polyuria, glycosuria, and thirst vanished, to be replaced by atrophy and cirrhosis of the liver. Glénard (Mercredi Méd., No. 44, '94).

Heart. — The heart-failure of chronic inebriates has for the past quarter of a century been continually presenting itself in my experience, often preceded by, or contemporaneous with, dilatation of the muscle. Alcohol has a direct action on the involuntary muscular system, and the heart is more responsive to its dilating action than any other part of the bodily structure.

The three cardinal symptoms of heart-failure are generally observed early in alcoholic cases, though the prognosis is good providing alcohol be abandoned as soon as the immediate therapeutic necessity for its use has ceased. Graham Steele (Med. Chronicle, Apr., '93).

Dynamometer shows that the muscular strength is diminished under influence of even moderate doses of alcoholic drinks. Fürer (Le Bull. Méd., Aug. 25, '95).

The heart is fatty and covered in parts by fatty tissue. It is usually flabby, pale, and antemortem clots are likely to be formed in the cavities. These conditions predispose to sudden death.

Alcoholic myocarditis, with consecutive hepatic disturbance and temporary albuminuria, is found as a clinical form in men of middle age, between 25 and 50 years; in women it is much more uncommon. In all cases abuse of alcoholic drinks may be looked upon as the cause. It begins slowly and progressively. The first symptom consists in dyspnœa, when the patient speaks or goes upstairs, later during walking. Fragmentary myocarditis is found anatomically. An increase in the size of the liver is added to the dilatation of the heart. The kidney is finally affected. Aufrecht (Deutsche Archiv f. klin. Med., vol. liv, p. 615, '95).

Blood-vessels.—There is general arterial dilation with atheromatous thickening and brittleness, due to a cribriform condition resulting from the aneurismal dilatation. The motor cells are enlarged and pigmented, and their processes are covered with nuclei.

Case of œsophageal varicose veins in a chronic alcoholic subject who died from frequent and severe hæmatemesis. The varices ascribed to the direct effect of alcohol on the intima of the veins. Letulle (La Semaine Méd., Oct. 22, '90).

It paralyzes the vasoconstrictors and, at times, vasodilators of capillaries, causing local hyperæmia and stasis. Hypertrophy results from vasoconstrictor paralysis, and atrophy from vasodilator paralysis. Wilkins (N. Y. Med. Jour., Sept. 22, '94).

Lungs.—Chronic alcoholism, by lowering the condition of the system, renders more liable to both acute and chronic tuberculosis. Pleural adhesions and other evidences of active processes are frequently seen.

Post-mortem examinations of phthisical cases at St. Thomas's, London, showed that in 75 cases there was a strong history of alcoholism. In only 10 of these was there any history of inherited phthisis; in 46 (or over 60 per cent.) the liver was cirrhotic. Mackenzie (Brit. Med. Jour., Feb. 27, '92).

One of the most efficient prophylactic measures against tuberculosis would be the repression of alcoholism. Thorain (Revue des Sciences Méd. en France et à l'Etranger, July 15, '94).

Alcoholic excesses one of the main causes of tuberculosis by predisposing the system to bacillary action. The phthisis of drunkards presents peculiar characteristics in localization and evolution: the lesion, instead of being in left apex in front, is located at the right apex toward the back. Improvement usually follows the first attack, and recovery frequently ensues if the alcoholic habit is corrected. If continued, the disease suddenly assumes alarming character, involvement of both lungs, peritoneum, and meninges quickly causing death. Lancereaux (Le Bull. Méd., Mar. 6, '95).

The increase of tuberculosis is proportionate to that of alcoholism in France. Lagneau (Le Bull. Méd., June 26, '95).

Brain and Nervous System. — The meninges are often adherent and show inflammatory white patches and thickening. The brain is shrunken, with flattened, narrow convolutions and serous, ventricular, and subarachnoid effusion. There is general wasting of nerve- cells and fibres, with atrophied, tangled nerve-centres and great increase of connective tissue. In the brain-substance congestive bleeding-points are sometimes observed on section. Scavenger calls are met with in profusion, preying on nerve-elements. (Bevan Lewis.)

Mental disorders and crime are shown, by statistics, to have, in alcohol, one of their most potent etiological factors.

It is perfectly certain that from one-fourth to one-third of the lunacy of the United Kingdom is a result of the custom of drinking alcoholic liquors. J. J. Ridge ("Alcohol and Public Health," p. 63, '92).

Women charged in American police-courts with drunkenness and associated offenses are profoundly degenerate in body as well as in mind. T. D. Crothers (Brit. Med. Jour., Dec. 31, '92).

In fifteen years lunacy has, in Paris, increased 30 per cent., due to the advance of general paralysis and alcoholic insanity. The latter is now twice as prevalent as fifteen years ago. Alcohol is responsible for a third of the lunacy cases at the Dépot Infirmary, the tendency being more and more to homicidal mania in youths of barely twenty. Garnier (Quarterly Jour. of Inebriety, Apr., '92).

Histological examinations have shown that alcohol causes swelling of the dendrites; this is followed by nuclear changes, then by degeneration of the cell-structures.

Examination of an alcoholic brain by the Golgi method. Lesions of the neuraxon of the nerve-cell slightly involving the cell-body and dendrites. Colella (Arch. Ital. de Biol., p. 216, '94).

Alcohol produces well-marked changes in the nerve-cells, especially in those of the anterior horns of the spinal cord and in the sympathetic ganglia. They first lose their chromatin structure, the fine granular appearance gradually being replaced by an homogeneous swelling. Golgi method. Vas (Archiv für exper. Path. u. Pharm., B. 34, p. 141).

There is gradual disintegration of the cell-body after the apical processes have suffered. Here and there, in the neighborhood of the cell-body, the protoplasm seems to become frayed or eroded. In other cases the cell-protoplasm becomes vacuolated from within until the entire protoplasmic structure is channeled by holes and seams of liquefaction. Golgi method. Andriezen (Brain, '94).

Forty per cent. of crime and bad conduct come from inebriate parental degeneration. Corre (Quarterly Jour. of Inebriety, Jan., '94).

The form of alcoholism is determined by pre-existing anomaly of subject; alcoholic psychopathia often the consequence of parental addiction; psychopathia and alcoholism cause one another. Fürer (Le Bull. Méd., Aug. 25, '95).

[A large share in the genesis of melancholia is due to agencies lowering the general health, among which alcohol is conspicuous. Farquharson found 11 per cent. of asylum cases of melancholia due to intoxicants, while many victims of suicidal melancholia who had no insane heredity had a family history of inebriety. Norman Kerr, Assoc. Ed., Annual, '96.]

The literature of the past two years has demonstrated, more than that of previous periods, perhaps, the pathogenic influence of alcohol upon the brain. It has shown that, in proportion as it is used, so are mental disorders prevalent, the ratio of the increase of insanity corresponding to that of increased consumption of alcoholic beverages.

Neurological and pathological evidence, together with recent experimental work, show that in the early stages of the insanities there is a profound nutritive and dynamical failure in the nerve-elements of the brain, which finds expression in the insomnias, the melancholias, and the commencing loss of memory, with easily-induced mental fatigue which their subjects experience, and that the pathological facts ascertained, in so far as they afford us any light, force on us the conviction that we are dealing with serious nutritive and dynamical changes in the central nervous organ. W. Lloyd Andriezen (Quarterly Jour. of Inebriety, Jan., '96).

During four years, of 2169 patients received into the lunatic asylum at Rome, 340 (15.7 per cent.) owed their psychopathy to alcohol: 23 per cent. of the males, 4.6 of the females. Every form of mental disease to which alcohol may give rise is included in these 340 cases,

all doubtful cases being carefully excluded. Tables showing that, as the production and consumption of alcoholic liquors in Italy generally have increased, the number of insane patients admitted to the Roman asylum for alcoholic diseases has grown. A. Volpini (Il Policlinico, '96).

Alcoholism contributed to the population of the asylums of France, in 1894, 775 patients: 624 males and 151 females. The forms in the males comprised 282 cases of alcoholic delirium, 332 of chronic alcoholism, and 10 of absinthism. The females included 90 cases of alcoholic delirium, 60 of chronic alcoholism, and 1 of absinthism. Besides these, if we take account of the cases in which excesses in drink caused the entry into the asylum of patients who, without this cause, would have been able to get on outside, we find further 166 males and 63 females. The two groups—simple alcoholic cases and the insane with alcoholic causation, a total of 1004 patients—give a percentage of 38.42 of the males and 12.82 of the females admitted. Thus, on the average, one-third of the insanity of the Department of the Seine is due to alcohol. Magnan (Progrès Méd., May 23, '97).

Out of 1900 male insane patients treated in the Municipal Asylum of Dresden during the last five years, 500 were clearly traceable to alcoholism. Luhrmann (Archives de Neurol., No. 15, '97).

In England drunkenness is increasing, not only among the poor, but also among the upper classes, and especially among women of all classes. Out of 442 male inebriates treated at the Dalrymple Home and discharged as cured, 101 were university men, and 316 of the remainder were well educated; 235 were married, and the others were widowers or bachelors. In 228 cases sociability was said to be the cause, ill health caused the downfall in 36 cases, and overwork was given as the excuse for taking to drink in 32 cases. In 55 per cent. of the cases the excess was traceable to predisposing hereditary causes. About one-third of the cases treated are permanently cured. Out of the 442 patients discharged from the Dalrymple Home, 372 were kept trace of, and of these 149 were said to be entirely cured, 24 had improved, 164 had relapsed, 31 were dead, and 4 were insane. Editorial (Med. Record, Sept. 25, '97).

There are three types of cell-degeneration, viz.: (1) intense pigmentation of the larger cells, chiefly with degeneration of the cytoplasm; (2) a general cell-atrophy of the body and nucleus; (3) a great deal of change in the cell-body, with many neurogliar nuclei in the pericellular spaces. In the cases of alcoholism and alcoholic meningitis it was not possible to make out a distinct type of cell-degeneration, nor could this be expected, as these patients die, not so much from the alcohol, as from autotoxæmias and from the febrile process. Charles L. Dana (Med. News, May 1, '97).

Manner in which the pathological lesions and the symptoms correspond with one another: the sensory disorders, the exaggeration of the sensibility of the skin, the anæsthetic troubles, and the ocular and auditory disorders would correspond to the beginning of the vascular disorders, when the nerve-cells, irritated by an insufficient supply of proper nutriment, and excited by the presence of a poisonous stimulus, overact for the time; then, as nutriment is still withheld from them, altered metabolism results. The *beginning swelling of the dendrites of the sensorimotor region* is marked by paræsthetic symptoms, those of the purer sensory region by visual and ocular troubles, and some amnesia, especially for recent events; or, in other words, cells that have the function of evolving and transmitting thought cannot work properly, and defective memory results. Later, *as the motor cells are more and more involved and nuclear changes begin*, continuous tremor becomes apparent, the muscles no longer co-ordinate perfectly, unless for a moment under the direct influence of the will. Still later, *when a portion of the cell-structures have become highly degenerated and the altered cells have become more numerous*, the already tottering will-power becomes more and more deadened, memory and judgment fail, and, when the degenerative process is far advanced, an incom-

plete dementia is the final result. Henry J. Berkley (Johns Hopkins Hos. Reports, vol. vi, '97).

Beer. — Even under the excessive use of malt liquors, subjects rarely fail to put on fat. The blood shows an increased proportion of red and a diminished proportion of white corpuscles. Sudden cessation of drinking causes no other disturbances than a temporary longing, a rapid loss of flesh, and a decline in color. Stone in the bladder and cystic diseases are uncommon. Digestion is not retarded. Excess in beer is apt to produce subacute gastritis, especially in the summer. Cirrhotic kidney and hobnail liver are not found in beer-drinkers. Acute alcoholism is much more common than delirium tremens. (Lambert Ott.)

Four quarts of beer may be estimated to contain 240 grains of carbohydrates and scarcely 32 grains of albumin. Strümpell (Quarterly Jour. of Inebriety, Jan., '94).

The diminished vital resistance caused by the imbibition of alcohol renders the inebriate more liable to the development of disease than the temperate. Clinical experience has clearly sustained this view.

Experience in India and other warm countries has indicated an extreme fatality from sun-stroke in persons using alcohol to excess. Fifty cases of sun-stroke brought into the Presbyterian Hospital of New York.

The use of alcohol seemed to have a direct unfavorable influence. The habit was marked in 32 per cent., moderate in 46 per cent., denied in 10 per cent.; in the remaining 12 per cent. no history could be obtained. Eight persons were markedly alcoholic on admission, and of these four died. Editorial (Quarterly Jour. of Inebriety, Apr., '97).

Study of 247 recovered personal cases of delirium tremens: of these cases 202 were uncomplicated and 45 complicated by other diseases. Twenty-two cases were complicated by pneumonia, and when, also, the lethal cases observed by the author are taken in account, more than 12 per cent. of all cases of delirium tremens were combined with pneumonia. The delirium usually began on the fourth day of the pneumonia, but the evolution of the two diseases was individual, the one in no way influencing the other disease. Jacobson (Hospitalstidende, p. 143, '97).

The normal vital resistance of rabbits to infection by streptococcus pyogenes (erysipelatos) is markedly diminished through the influence of alcohol when given daily to the stage of acute intoxication. A similar, though by no means so conspicuous, diminution of resistance to infection and intoxication by the bacillus coli communis also occurs in rabbits subjected to the same influences.

While in alcoholized rabbits inoculated in various ways with staphylococcus pyogenes aureus, individual instances of lowered resistance are observed, still it is impossible to say from these experiments that, in general, a marked difference is noticed between alcoholized and non-alcoholized animals as regards infection by this particular organism.

It is interesting to note that the results of inoculation of alcoholized rabbits with the erysipelas coccus correspond in a way with clinical observations on human beings addicted to the excessive use of alcohol when infected by this organism. A. C. Abbott (Quarterly Jour. of Inebriety, Oct., '97).

Treatment. — The essential condition of cure is the entire discontinuance of all alcoholic beverages, whether spirits, wines, beers and other malt liquors, cider, etc. Records of reliable scientific hospitals and homes throughout the world show that, on an average, fully one-third of the cases so treated have been permanently cured.

After a prolonged trial of the Keeley and other treatments, that described by C. de Martines was adopted at the Cery retreat for inebriates. Almost always the patient during the first few days becomes violently agitated, throws things

about and attempts to hurt himself and others; so, as restraint has a bad effect, he is allowed free movement in a room with padded walls and devoid of furniture. Two glasses of wine a day are allowed during the first week or two, but no longer. As soon as the mental excitement subsides, the patient is made to walk in fresh air until tired, and takes a warm bath for half to one hour each day. The only drugs used are chloral-hydrate, 20 to 30 grains, to produce sleep, preferably given in a little wine or beer, or, if this is refused, $^1/_{60}$ grain of duboisine or hyoscine hypodermically. Morphine is never employed, as it is considered responsible for many untoward effects in the treatment of these cases. The bowels are regulated by artificial Carlsbad salt or other saline purgative. The lungs are examined every morning, as at any time a pneumonia may develop. Any medication is more rapidly absorbed if it is given in a slightly alcoholic mixture. (Revue Méd. de la Suisse Rom., Mar. 20, 1900).

There is no specific. After treating the immediate symptoms of breakdown, delirium, etc., by flushing the intestinal canal and administering food and effervescents suited to the harassed and irritated digestive apparatus, the chief drug reliance should be on nerve-tonics, such as strychnine and nux vomica, combined with cinchona, quinine, iron, chiretta, gentian, and calumba. Complications must also be attended to, as syphilis by mercury or potassium or sodium iodide, and ague by quinine, bebeerine, or arsenic.

Caffeine is almost a specific in alcoholic toxæmia. This drug, in doses of from 1 to 2 grains every one, two, or three hours, will usually, in from twenty-four to forty-eight hours, quench the thirst or craving for alcohol to such an extent that the most confirmed *habitués* will voluntarily abandon its use. Four cases are reported which seem to uphold the author's contention. Hall (Med. News, Oct. 31, 1903).

The indications are to prevent the alcoholic poisoning going further, by the immediate withdrawal of alcoholic beverages, which superabundant experience —in prisons, work-houses, hospitals, and homes for the treatment of the disease of alcoholism—has shown to be quite safe; to antagonize or remove the exciting causes; and to reconstruct healthily body and brain. The highest influences of art, intellect, morals, and religion should be invoked to restore inhibition and re-establish the lost will-power. Massage, galvanism, muscular exercise, especially in the open air, working at a congenial occupation, bathing (including the Turkish or Roman bath), with all healthful and invigorating hygienic exertions, are useful adjuncts to medicinal therapeusis.

The peculiarities of each case should be studied, and it is important to instill into the alcoholist's mind the necessity for life-long abstinence from the toxic substance, just as in chronic lead or arsenic poisoning, with both of which intoxications alcoholism has much in common.

Strychnine hypodermically has been recommended. The nitrate or sulphate is usually administered in doses of $^1/_{30}$ to $^1/_6$ grain daily, or oftener, as indicated by the gravity of the case.

Strychnine used, $^1/_{48}$ grain hypodermically, gradually increasing the dose till physiological effects declared themselves, the highest dose thus injected being $^1/_{16}$ grain. At the same time $^1/_{64}$ grain of strychnine nitrate is given by the stomach every two hours, together with from $^1/_{250}$ to $^1/_{500}$ grain of atropine sulphate in gentian infusion. J. H. Ward (Med. World, Dec., '93).

History of twenty-five cases of alcoholic mania treated with nitrate of strychnine subcutaneously injected. The dose varied from $^1/_{30}$ to $^1/_6$ grain twice daily for ten days, then once daily for ten days, the highest dose being reached

about the third or fourth day and continued to the close of the treatment. This administration is in accord with Spitzka's experiments, that to maintain its action the doses of strychnine must be at first increased; later the interval increased and the doses lessened. The border-line of tolerance was reached, in most cases, when 15 minims were used of a solution containing 2 grains of strychnine nitrate to 4 fluidrachms of water: equal to $^{2}/_{15}$ grain. Internally, cinchona, peroxide of hydrogen, and capsicum were frequently prescribed in combination. When sodium bromide failed to procure sleep paraldehyde always succeeded. In the latter case, strychnine, in doses of $^{1}/_{20}$ grain, with elixir of phosphates and calisaya, was ordered to be taken once or twice daily for four to five weeks after ceasing the injections. There were fourteen relapses known in these twenty-five cases from within one to eleven months. Though strychnine is useful in restoring temporary health, it does not prevent the possibility of further relapse. J. Bradford McConnell (Quarterly Jour. of Inebriety, Jan., '94).

In the alcohol wards of the Bellevue Hospital the use of strychnine and the solanaceæ, with certain adjuvant tonics and moral influences, is employed in cases of periodic alcoholism. The drugs selected are those which the experience of ten years in the care of these cases has shown to be most useful. Selected patients, after having passed through an attack of acute alcoholism, and are convalescent, are allowed to remain two days. Only persons who have reasonable intelligence and who show real evidence of sincerity are chosen. The following solutions are used:—

℞ Strychnine nitrate, $^{1}/_{15}$ grain.
Atropine sulphate, $^{1}/_{300}$ grain.
Distilled water, 10 minims.
M. Sig.: Inject t. i. d.

First day injection.

℞ Strychnine nitrate, $^{1}/_{20}$ grain.
Atropine sulphate, $^{1}/_{200}$ grain.
Water, 10 ounces.
M. Sig.: Inject t. i. d.

Second day injection. C. L. Dana (Post-graduate, July, '96).

Once insomnia has disappeared, the propitious moment for the use of strychnine has arrived. The period of depression will be more or less prolonged; the malnutrition, already great during the acute attack, will increase; all the functions will droop unless a stimulant is found to increase the vital forces, and, usually, alcohol is the stimulant instinctively sought for by the victim, who thus treads in a vicious circle. To avoid this a stimulant other than alcohol must be selected for the patient, and not by him: a medicine, and not a sort of food. The most appropriate for this purpose is strychnine, as it meets all the requirements rendering its employment necessary. Combemale (Le Bull. Méd., Apr. 12, '96).

The principal indication for the strychnine treatment is found in cases of confirmed alcoholism without acute attacks. But, in fatty degeneration of the organs, the strychnine treatment does not and cannot produce any modification of the symptoms. It even constitutes a danger. Strychnine is slowly eliminated by the urine, the saliva, and the bile, even when the organs are intact and prevent accumulation. Hence, cirrhosis of the liver and renal impermeability are two more great contra-indications to the employment of this drug. Case of an alcoholic, who suffered from cirrhosis of the liver with ascites, in whom tetanic symptoms occurred after the fifth injection. Mercier (Gaz. Heb. de Méd. et de Chir., May 16, '97).

Strychnine is a valuable drug both as a tonic and a stimulant, but should not be given alone except immediately after the withdrawal of the spirits. T. D. Crothers (Penna. Med. Jour., Apr., '98).

Nothing gives results equal to strychnine. One patient will do well on $^{1}/_{24}$ grain, four times daily; another will get worse on so small a dose as $^{1}/_{60}$ grain. It is most important, therefore, to study each case. The proper dose can usually be determined in two days. Patients gain from 5 to 20 pounds in from three to four weeks. If no improvement occurs, either too much is given or not enough. G. de Nike (Med. World, Feb., 1901).

In the nervous disturbance of drug *habitués* depending upon the disturbance of the vascular system the indication is to bring about promptly an equilibrium of the circulation, and for doing this the hypodermic injection of ergot is the most certain method. Ergot contracts the muscular coat of the blood-vessels, but its most pronounced action is upon areas of such tissue as are weak and relaxed, and hence its action on dilated blood-vessels is peculiarly satisfactory.

The first step in the treatment of these drug habits is to discontinue the use of the narcotic or of any substitute therefor. The use of ergot is begun at once, giving a purgative at the same time, and the bowels are kept open. In general, two or three doses of ergot of $^1/_2$ drachm each of a solution consisting of 1 drachm of the extract dissolved in 1 ounce of water are given daily, but in extreme cases it may be necessary to employ the drug at intervals of two hours. The ergot method acts admirably in the morphine habit, the most difficult of all to cure. A. T. Livingston (Merck's Archives, Nov., 1903).

Having found liquor ammoniæ acetatis in acute alcoholism, and strychnine (both by the mouth) in subacute and chronic alcoholism, quite as effectual as the subcutaneous administration, I eschew the latter method. The simpler and safer the remedies used, the more permanent and helpful will be the treatment to the sufferers.

Hypnotism has been lauded as a curative agent, but I cannot recommend it, having seen many cases in which it has failed and some in which it has left mental injury. Still less can I advise recourse to alleged remedies, or remedial processes, the composition or particulars of which are kept secret. I have seen substantial mischief after the use of various "cures" of this description.

"Gold-cures," whenever analyzed, contain no gold whatever. Gold is non-assimilable, and inebriety is not reached by drugs alone or by special, concealed plans of treatment. In many cases of inebriety which have been cured in gold-cure asylums, there is concealed periodicity. There are no facts to show that gold has any value in the treatment of this disease. Crothers (Jour. Amer. Med. Assoc., Oct. 8, '98).

The strong claims for the efficacy of a remedy for drunkenness led to a curiosity to determine what it contained. Some of these remedies, as is well known to physicians, are merely alcoholic preparations, others contain tartar emetic. The article in question sells at one dollar per box, containing twelve powders, weighing about 9 grains. The powder gave no evidence of any of the ingredients expected. On being heated in a platinum crucible, it charred, emitted an odor of burnt sugar, and finally burned away, leaving but a trace of ash. No antimony nor mercury compound was present. Ammonium chloride was detected. There was no alkaloid nor alkaloidal salt. The only materials that could be found were milk-sugar and ammonium chloride. Henry Leffmann, Laboratory of the Philadelphia Medical Journal (Phila. Med. Jour., Jan. 24, 1903).

To Produce Distaste for Liquors. — Time, patience, control, and study of individual peculiarities are required. Strychnine, sometimes atropine, judiciously employed, are at times useful; but there is no specific.

Small doses of atropine, less than $^1/_{100}$ grain, hypodermically, three or four times a day, produce distaste in from one to five days. Carter (Med. News, Mar., '95).

Same effect produced by ipecac, 20 minims of the fluid extract used as an hypnotic. Waugh (Med. Age, June 25, '95).

To overcome longing for drink, due to irritation of gastric nerve-supply:—

℞ Chlorinated water, 2 drachms.
Decoction of athæa, 5 ounces.
Cane-sugar, 2 drachms.

M. Sig.: A tablespoonful every two or three hours. Zdekauer (La Méd. Mod., Jan. 12, '95).

Disgusting an inebriate of alcoholic intoxicants is not to cure the disease of inebrity, or narcomania.

Excessive irritation following the removal of alcohol is often very quickly removed by the bromides. They should be given in large doses of at least 2 drachms every four hours in large quantities of water flavored with peppermint or tincture of cinchona. As soon as the bromidial effects are noticeable, small doses of bitartrate of potassa and sulphate of magnesia should be given, with warm shower-baths, twice a day. Brominism is usually very slight after this, and only the slight sedative effects remain. Bromide of sodium seems to be the most powerful and prompt in its action. In vigorous plethoric inebriates, with a high degree of mental irritation and delirium, the sudden withdrawal of spirits and the substitution of bromide of sodium, 100-grain doses every three or four hours, is followed by rapid recovery.

Many cases cannot bear the bromides: they seem to intensify the debility and depression from spirits. Chloral should never be combined with bromides for its sedative effect, especially in inebriates. When the temperature falls and the heart becomes feeble, all bromides should be stopped. When low muttering delirium comes on, with muscular enfeeblement, the bromides are dangerous. Its indiscriminate use for all cases is unsafe, and its action should be watched carefully. Editorial (Quart. Jour. of Inebriety, Apr., '98).

Exception taken to Reid's theory of immunity against drunkenness obtained by use of alcohol for successive generations. A certain degree of immunity to the action of alcohol on the tissues may be attained, but not to the taste or liking of alcohol. A direct transmission of the taste for alcohol never occurs. Drunkenness as a disease is not transmitted, but only the weakly and unbalanced condition of the tissues of alcoholic parents. G. Sims Woodhead (Lancet, July 29, '99).

Conclusions regarding the use of apomorphine hydrochlorate as hypnotic in alcoholism are: 1. To obtain a hypnotic action with apomorphine it should be given hypodermically. 2. The dose cannot be fixed. It is best to begin with a small dose,—$^1/_{30}$ grain or less,—and to repeat this or give a slightly larger dose within a short time. Further doses should not be given after vomiting occurs until several hours have passed. 3. Doses repeated in two or three hours have but little beneficial effect. 4. The administration of apomorphine should not be repeated in patients who are weak. 5. The duration of the hypnotic action is only a few hours, and when the patient awakes his condition is practically unchanged, except in "ordinary drunks." 6. The best results are obtained from apomorphine when it is followed in two or three hours by some recognized hypnotic, as bromide, chloral, paraldehyde, etc. 7. Solutions of apomorphine are unstable, and should be freshly made for use. Old solutions should never be used. 8. Apomorphine may be employed as a hypnotic in selected cases of alcoholism. The best results were obtained in "ordinary drunks" and in cases verging on delirium tremens. But in some of these cases the drug has no effect whatever. 9. The administration of apomorphine to patients in delirium tremens was, as personally observed, without beneficial result, and may even be attended with danger from its depressing action. Warren Coleman and J. M. Polk (Amer. Med., March 8, 1902).

Fresh fruits (oranges, etc.), an emetic, or a cup of hot tea, coffee, or cocoa are frequently sufficient to counteract the drink crave or impulse.

For *insomnia*, hyoscine hydrobromate, $^1/_{200}$ to $^1/_{100}$ grain, cautiously given, or a hot, wet pack is useful.

The use of hyoscine hydrobromate is to be recommended, but its abuse will do more harm than good. The dose is from $^1/_{300}$ to $^1/_{100}$ grain, increased cautiously to $^1/_{50}$ grain. Lionel Weatherley (Jour. of Mental Science, July, '91).

Lott's treatment of alcoholic and morphine habits with hyoscine tried in

6 cases: The patients can take massive doses for days at a time, as much as $^1/_4$ grain each day hypodermically, with no evil effects on any vital function. They suffer very slightly, if at all, from the immediate withdrawal of the morphine. The desire for the drug is largely, if not entirely, dissipated after a few days. H. A. Hare (Med. News, June 7, 1902).

Chloralose has also been recommended as an hypnotic in these cases, its soothing effect continuing even after its influence as a soporific has been exercised.

In *heart-failure* the preparations of ammonia, especially the aromatic spirits, are effective.

In the heart-failure of chronic inebriates rest in bed and digitaline granules, one of $^1/_{240}$ grain being usually sufficient. Graham Steele (Med. Chronicle, Apr., '93).

Nitroglycerin is recommended against the vomiting of alcoholism. R. Humphreys (Brit. Med. Jour., Apr. 1, '93).

The influence of surroundings should not be disregarded. The patient should be separated from those of his associates who cater to his weakness, and made to enjoy, if possible, the company of those who, on the contrary, tend to counteract his habits.

1. The patient should be instructed in regard to deceptive and injurious influences of alcoholic drinks, so that he is actually convinced that their use is, on all occasions, unnecessary. 2. The patient should be placed under good physical and social surroundings. For impaired digestion, irritable nervous system, and disturbed sleep, $^1/_{60}$ grain of digitaline with $^1/_{30}$ grain of strychnine at each meal, with from 20 to 30 minims of diluted hydrobromic acid at bed-time, will give excellent results. For constipation, 30 minims of fluid extract of rhamnus purshiana may be added to the acid. Instead of the digitalis and strychnine, a pill or capsule of a grain of extract of hyoscyamus, with 3 grains of cerium oxalate, may be given. Before an anticipated period of dissipation a pill of 2 grains of quinine sulphate, the same amount of extract of eucalyptus globulus, and $^1/_8$ grain of extract of cannabis Indica should be given with each meal for two weeks. 3. The patient should be separated from his associates, and, if this cannot be done in any other way, he should reside in a well-regulated asylum for six to twelve months. N. S. Davis (Quarterly Jour. of Inebriety, Apr., '97).

Prophylaxis.—Successful prophylactic measures must include power to compulsorily seclude chronic alcoholics who are too will-paralyzed to apply for curative seclusion voluntarily; the teaching of the young in the poisoning influence of alcohol; the protection of infants against contamination from alcoholic nurses; the abstinence propaganda, especially among the rising generations; and suppression of the liquor traffic, either by a vote of localities or by general national prohibition.

In Switzerland, in the Canton of St. Gall, by a law passed in 1891, anyone rendering himself obnoxious or dangerous to his family or to the community, through drinking, may, with a medical certificate, be sent to an inebriate asylum, and be paid for out of the public poor-funds, if his friends are unable to defray the expense. Editorial (Quarterly Jour. of Inebriety, Oct., '92).

The disorders to which infants are exposed when nursed by women who partake too freely of stimulants—infant nervous attacks, convulsions, etc.—are frequently attributed to other causes. (Vallin.)

The majority of the posterity of drunkards and of persons of an ill-balanced nervous system should abstain altogether from alcohol, or, at least, before partaking of it, consult a competent physician. Sir Dyce Duckworth (Lancet, Aug. 26, '93).

Cases of alcoholism in children showing importance of not prescribing alcohol. Goriatchkine (Wratsch, No. 15, '96).

Serum-therapy has also been tried in alcoholism. The serum is obtained from a horse previously subjected to a course of alcohol. It is injected hypodermically, 80 minims at a time, every three or four days, until a peculiar morbillic eruption appears. The patient is then given a rest of about a week's duration, after which a final injection completes the cure. A gradually increasing disgust or intolerance for liquor culminates in an absolute abhorrence of it. Suggestion plays no part in the cure, success having resulted when the patient was unaware of the object of the treatment, while no restriction was placed on the ordinary habits. Of fifty-seven cases thus treated by Thiébault (La Tribune Méd., p. 566, 1900), all except those who either had some organic disease or else discontinued the remedy before its physiological effects had been produced are said by him to have been cured.

Immunization by ethylic alcohol. Dogs were subjected to increasing doses of alcohol administered, well diluted, through the œsophageal tube until tolerance was established for a larger than an ordinary lethal dose. The serum of these animals was employed in the experimentation. The author concludes that (1) it is possible to confer a real immunity in dogs by administering progressively increasing doses of this poison, ultimately reaching very large doses without producing functional disturbances or organic degenerations; (2) the serum of such a dog rendered immune to alcohol contains a special antitoxin capable of neutralizing the toxic action of a dose of alcohol one-fourth larger than the minimum fatal dose; (3) normal blood-serum does not possess the power of augmenting the organic resistance to alcohol, much less to explain the curative action in acute poisoning. Dott. Luigi Maramaldi (Gaz. Inter. di Med. Pract., No. 1, p. 9, '99).

Medico-legal Considerations.—Though there is some difference in the medico-legal treatment of alcoholism in different countries, there is a general agreement as to the form of civil law in the premises.

Insurance.—The concealment by proposers and their referees of the intoxication of the assuring may render a policy void. There are probably at least 600,000 reformed drunkards in the world. Some offices reject such lives, others accept them. The writer believes that they are mostly insurable, after a certain term of years of abstinence, with a weighting of the premium. It is sometimes difficult to settle whether a person has died from accident or from acute or chronic alcohol poisoning. Insurance companies lose largely by the alcoholism of the insured. (Crothers, Mattison, Fox, Kerr.)

Report of British Medical Association on the mortality from alcoholism, based on an examination of 4222 cases. It also contains returns as to the alcoholic habits of the inhabitants of Great Britain, and as to the relative alcoholic habits of different occupations and classes. The following conclusions reached:—

"1. Habitual indulgence in alcoholic liquors beyond the most moderate amounts has a distinct tendency to shorten life, the average shortening being roughly proportional to the degree of indulgence.

"2. Men who have passed the age of 25, the strictly temperate, on an average, live at least ten years longer than those who become decidedly intemperate. We have not, in these returns, the means of coming to any conclusion as to the relative duration of life of total abstainers and habitually temperate drinkers of alcoholic liquors.

"3. In the production of cirrhosis and gout alcoholic excess plays the very marked part which it has long been recognized as doing; and that there is no other disease anything like so distinctly traceable to the effects of alcoholic liquors.

"4. Apart from cirrhosis and gout, the

effect of alcoholic liquors is rather to predispose the body toward attacks of disease generally than to induce any special pathological lesion.

"5. In the etiology of chronic renal disease alcoholic excess, or the gout which it induces, probably plays a special part.

"6. There is no ground for the belief that alcoholic excess leads in any special manner to the development of malignant disease, and some reason to think that it may delay its production.

"7. In the young alcoholic liquors seem rather to check than to induce the formation of tubercle, while in the old there is some reason to believe that the effects are reversed.

"8. The tendency to apoplexy is not in any special manner induced by alcohol.

"9. The tendency to bronchitis, unless, perhaps, in the young, is not affected in any special manner by alcoholic excess.

"10. The mortality from pneumonia, and probably that from typhoid fever also, is not especially affected by alcoholic habits.

"11. Prostatic enlargement and the tendency to cystitis are not especially induced by alcoholic excess.

"12. Total abstinence and habitual temperance augment considerably the chance of death from old age or natural decay, without special pathological lesion." Isamberd Owen (British Med. Jour., June 23, '89).

Evidence.—Evidence of an intoxicated witness is not receivable.

Confession of an intoxicated person is valid, if no inducement has been held out (England).

Contracts executed while intoxicated are voidable.

Wills made while intoxicated have been voided. Intoxication and incapacity, it was held, must be complete, till 1892 (Tyler *v.* Maxwell, Court of Session, Edinburgh, Nov. 1, 1892), when Lord Wellwood ruled that the defensive plea of intoxication having to be total, though true in a sense, did not mean total disablement by drink. And (Morgan and another *v.* Kitchen, Probate and Divorce, High Court, London, 1891), though a first will was held good, one executed a year later was pronounced bad, on the ground that the testator had (though not intoxicated when he made the second disposition) become, after the earlier date, mentally incapacitated after frequent (not intoxication but) "taking his drops," and after delirium tremens. Attestation is invalid if done by an intoxicated attestator, but presumption is in favor of validity.

Criminal Jurisprudence.—Under Greek law crime committed in intoxication was liable to double punishment. Roman law remitted capital punishment to intoxicated soldiers. Mohammedan law does not admit a plea of intoxication. New York Penal Code holds no act less criminal by having been committed while intoxicated, but intoxication considered to determine purpose, motive, and intent. Voluntary intoxication is not a defense in homicide without provocation. Delirium tremens, as a disease secondary to voluntary intoxication, has been accepted in many trials in England and the United States as a valid plea for irresponsibility (Justice Stephen, Newcastle, 1881; Justice Hawkins, Shrewsbury, 1895), though this ruling has not been followed by some other judges. In other trials the accused has been acquitted as having been unable, from intoxication, to have been capable of any intent, or as having been the subject of a well-defined mental disease, as having (through inherited or acquired mental weakness) been unable to drink intoxicants without insane sequelæ like the average man. English law also takes drunkenness into account (Lord James) "if it produces a sudden outbreak of passion causing the commission of crime under circumstances which, in a sober person, would reduce a charge

of murder to manslaughter." Altogether there has generally been a growing tendency of judges and juries to take alcoholism (with mental disturbance) into account, during the past thirty years. German and Swiss law prescribes a difference in the punishment of offenses committed in culpable and inculpable intoxication.

Minor Offences. — In theft and other minor offences, in England, committed in alcoholism, intoxication and delirium tremens have been accepted as an answer in some cases, while many such offenders have been liberated, to come up on their own recognizances with a limited time if called on, on the understanding that they would forthwith go to a Home for Inebriates.

> Inebriety is a disease of the brain, a form of insanity wholly dominating the volition, and beyond the power of the victim to control. Clark Bell (Medico-Legal Jour., Dec., '92).
>
> The affirmation of irresponsibility should involve prolonged commitment to an insane asylum. Motet and Vidal (Quarterly Jour. of Inebriety, Jan., '93).
>
> The knowledge of right and wrong may exist without the power of discriminating between the two. T. L. Wright (Quarterly Jour. of Inebriety, Jan., '93).
>
> Criminal acts come from inability to understand the relation of surroundings, and to adjust the conduct to the varying conditions of life. The criminal acts of the inebriate spring from this confusion of senses and judgment. This shows the irresponsibility of inebriates. T. D. Crothers (Quarterly Jour. of Inebriety, Jan., '93).
>
> At meetings of creditors, by the author's advice, legal advisers have refrained from calling as witnesses persons whose brains had been so affected by intoxicants as to dim the perception of truth and render their evidence valueless. Norman Kerr ("Inebriety," third edition).
>
> By existing British law, habitual drunkenness, as such, forms no defense, either in civil or criminal cases, except in so far as it may be admissible as evidence with a view to prove facts which can be construed as establishing legal incapacity or insanity. J. R. McIlraith (Proceedings of the Soc. for the Study of Inebriety, Aug., '93).
>
> Statistics based on 1500 cases (1200 men and 300 women) of alcoholic insanity having required entrance into an asylum show that more than two-fifths of delirious alcoholic patients had committed crimes or misdemeanors. Of these acts the most frequent are those directed against the life, and especially attempts of suicide. Serré (Paris Thesis, '96).

In some of the more recent trials certain diseased inebriate mental states, short of what is generally regarded legally as insanity, have granted exemption from responsibility. This recognition of such abnormal mind conditions as a legal answer has, however, had to be entered as a plea of insanity and not inebriety. It is greatly to be desired, in the interests alike of equity and justice, that certain abnormal, inebriate, disordered mental states should be accepted as a valid plea altogether from the standpoint of insanity. The alternative would be the classification of such pathological states of mind as a variety of mental unsoundness, as in Belgian law. The former method of a distinct, independent, legal recognition is, however, preferable, if for no other reason than that the inebriate should not be associated in treatment with the insane.

> On the first of January, 1900, all the German States will have a common civil law. The sixth paragraph of the new Code runs thus: The Interdicted can be:
>
> 1. He or she who, in consequence of mental insanity or mental weakness, cannot provide for his or her affairs.
>
> 2. He or she who brings himself or his family into the danger of need by prodigality.
>
> 3. He or she who, in consequence of inebriety, cannot provide for his affairs,

or brings himself or his family into the danger of need or endangers the safety of others.

The interdiction is to be revoked as soon as the reason for interdiction ceases to exist. William Bode (Proceed. of the Soc. for the Study of Inebriety, Nov., '97).

NORMAN KERR (London) and CENTRAL STAFF (Philadelphia).

ALEXIA. See APHASIA.

ALKALOIDS. — The alkaloids are organic basic substances, the active principles of most poisonous plants. They are termed "alkaloid" owing to their behavior with acids, which simulates that of alkaline substances: ammonia, etc. Combining with acids they form salts which are convenient, owing to the smallness of their doses and their comparative precision as to the effects to be produced.

Dose and Properties.—A point of importance in prescribing alkaloids, when they are administered in tablet form, is to avoid too rapid drying of the tablets, the preparation otherwise becoming deteriorated.

Case showing that certain alkaloids are so delicate that they are injured if the tablets are dried too quickly. A prescription of his, calling for a tablet of hyoscyine, morphine, and atropine, was dried in a half-hour instead of a day and a half, as recommended to him by druggists. J. A. Cutter (Medical Bulletin, June, '90).

The following alkaloids are official in the United States Pharmacopœia, but many others are employed that will be considered under their appropriate headings:—

Apomorphine hydrochlorate, dose, $^1/_{16}$ to $^1/_4$ grain.

Atropine, dose, $^1/_{200}$ to $^1/_{60}$ grain.

Atropine sulphate, dose, $^1/_{200}$ to $^1/_{60}$ grain.

Caffeine, dose, 2 to 10 grains.

Caffeine citrate, dose, 2 to 5 grains.

Caffeine effervescent citrate, dose, 1 to 3 drachms.

Chinoidine, dose, 3 to 30 grains.

Cinchonidine sulphate, dose, 5 to 40 grains.

Cinchonine, dose, 5 to 30 grains.

Cinchonine sulphate, dose, 5 to 30 grains.

Cocaine hydrochlorate, dose, $^1/_2$ to 2 grains.

Codeine, dose, $^1/_6$ to 2 grains.

Hydrastine hydrochlorate, dose, $^1/_4$ grain.

Hyoscine hydrobromate, dose, $^1/_{150}$ to $^1/_{100}$ grain.

Hyoscyamine hydrobromate, dose, $^1/_{64}$ to $^1/_{32}$ grain.

Hyoscyamine sulphate, dose, $^1/_{60}$ to $^1/_{32}$ grain.

Morphine, dose, $^1/_{10}$ to $^1/_2$ grain.

Morphine acetate, dose, $^1/_6$ to $^1/_2$ grain.

Morphine hydrochlorate, dose, $^1/_6$ to $^1/_2$ grain.

Morphine sulphate, dose, $^1/_6$ to $^1/_2$ grain.

Physostigmine salicylate, dose, $^1/_{64}$ to $^1/_{20}$ grain.

Physostigmine sulphate, dose, $^1/_{100}$ to $^1/_{60}$ grain.

Pilocarpine hydrochlorate, dose, $^1/_{12}$ to $^1/_3$ grain.

Piperine, dose, $^1/_2$ to 10 grains.

Quinidine sulphate, dose, 5 to 30 grains.

Quinine, dose, 1 grain to 1 drachm.

Quinine bisulphate, dose, 1 to 15 grains.

Quinine hydrobromate, dose, 1 to 20 grains.

Quinine hydrochlorate, dose, 1 to 15 grains.

Quinine sulphate, dose, 1 grain to 1 drachm.

Quinine valerianate, dose, 1 to 20 grains.

Sparteine sulphate, dose, $^1/_8$ to 1 grain.

Strychnine, dose, $^1/_{60}$ to $^1/_{20}$ grain.

Strychnine sulphate, dose, $^1/_{60}$ to $^1/_{20}$ grain.

Veratrine, dose, $^1/_{60}$ to $^1/_{30}$ grain.

Physiological Action.—Alkaloids have various degrees of physiological activity when introduced into the animal body. Many are slow in their action, and a large dose is required to produce any observable effect, while others act more rapidly, and are so potent that even a minute dose may destroy life. Compare, for example, narcotine, one of the alkaloids of opium, with nicotine, the alkaloid of tobacco. Twenty to 30 grains of the former have been taken by the human subject without producing any marked symptoms, while the twentieth part of a grain of the latter may induce symptoms so severe as to threaten death. It is also well known that alkaloids may have a different kind of action on different animals. Thus, $^1/_4$ grain of atropine will produce serious symptoms of a complex character in a dog, while 3 or even 4 grains may be given to a rabbit without causing any more marked effect than dilatation of the pupil. In considering the physiological actions of those substances, the following generalization may, in the present state of science, be made tentatively: 1. As a general rule, the more complex the organic molecule, and the greater the sum of its atomic weight, the more intense will be the action of the substance. 2. Substances that split up quickly into simpler bodies produce rapid, but transient, physiological effects, whereas substances which resist decomposition in the blood or tissues may produce no appreciable results for a time, but, when they do begin to break up, the effects are sudden and violent, and usually last for a considerable time. 3. Alkaloids have frequently a double action on different parts of a great physiological system; and their action in a particular group of animals will depend on the relative degree of development of the parts of the system in that group. Thus most of the alkaloids of opium have such a double action: a convulsive action resembling that of strychnine, due to their influence on the spinal cord or on the motor centres in the brain; and a narcotic, or soporific, action resembling that of anæsthetics, due to their influence on sensory centres in the brain. Hence, in animals, where the spinal system predominates, as in frogs, these alkaloids act as convulsants; while in the higher mammals their principal action is apparently on the encephalic centres, which have now become largely developed. (J. G. McKendrick.)

Besides the individual physiological properties of alkaloids (these will be described under their respective headings), a few possess a property in common: that of reducing temperature when applied to the surface. This question was studied by Guinard and Geley, of Lyons. Of eighteen substances tried by the authors in solution or as ointments applied on the inner part of the thighs, four were found to possess a constant regulating effect upon thermic reaction. These were cocaine, solanine, sparteine, and helleborine. In cases of true hyperpyrexia a lowering of from 0.9° to 5.4° F. was produced, the average fall being from 1.8° to 2.7° F., the effect varying according to the patient, and especially according to the disease. They produced a more marked change at the beginning and end of acute affections than in the middle of the attack, and in mild rather

than in grave forms. In healthy subjects the effects were less apparent. It may be hoped to influence the temperature in this manner without administering the remedy internally.

Therapeutics. — As these agents are extensively administered hypodermically, it was at one time feared they might serve as vehicles for micro-organisms which in themselves might become pathogenic. In a series of experiments having for their object to answer these questions and to determine a method for the sterilization of such medicines Marinucci found (1) that, while all preparations studied contained microbes, all these microbes are not harmful. (2) That sterilization by heat does not alter solutions of strychnine, curare, bihydrochlorate of quinine, or borate of eserine. It enfeebles, but does not alter, the character of morphine and atropine. After sterilization, however, these drugs must be used in larger doses. The sulphate of eserine was found to be seriously altered, so that the solutions were, in a great measure, rendered inert. (3) That, to those solutions which are altered by heat, corrosive sublimate should be added in the proportion of 1 to 10,000. This seems to be efficacious, and in no way to injure the value of the alkaloid when given hypodermically.

Legal Medicine.—In medical jurisprudence alkaloids often come into play, the smallness of the dose of many of these salts serving the purpose of evil-doers or suicides. By well-known means their presence may be determined in the majority of cases; but still obscure in this connection is the influence of putrefactive processes—such as those which take place, after death, in the body—upon alkaloids which may have been administered during life. Ottolenghi recently conducted a number of experiments in order to ascertain the action of saprophytic micro-organisms on atropine and strychnine. He first tried the effect of adding a known quantity of atropine to some sterilized bouillon (1 to 10,000), which was afterward tested by dropping a couple of drops of it into a rabbit's eye. The usual effects of atropine ensued: the pupil dilated fully under the influence of the unaffected atropine. He then substituted for the sterilized bouillon separate cultures, in bouillon, of bacillus mesentericus, bacillus vulgatus, bacillus liquefaciens putridus, bacillus subtilis, and bacillus diffusus, which he had obtained from a human cadaver, the result being that the mydriatic effect of the atropine was entirely destroyed in four or five days by the action of the micro-organisms. A similar series of experiments were made with strychnine, the test for the alkaloid being that of injecting a certain quantity of the solution into a frog, the quantity being proportionate to the weight of the frog. It was found that for the first few days the toxic action of the strychnine, subjected to the influence of the bacteria, was distinctly increased; subsequently it was diminished. Some separate experiments made with cultures of bacillus coli and strychnine showed that, with this bacterium, the toxicity of the alkaloid materially diminished from the first. After an exposure of three months the alkaloid had lost one-half of its potency. (J. Dixon Mann.)

ALOES. — The preparations of aloes employed in the United States are obtained from two varieties: the *Aloë Barbadensis*, or *Vera*, and the *Aloë Socotrina*. The former is the inspissated juice of the Barbadoes, or Curaçoa, aloes and occurs in orange-brown, opaque, resin-like masses that give off an odor of saffron,

and are extremely bitter to the taste. The Socotrine aloes is the inspissated juice of the *Aloë Perryi*. It varies in color from a yellowish brown to an opaque, reddish brown and also occurs in resinous masses and emits the same saffron-like ordor and is as bitter to the taste.

> 1. Curaçoa aloes are as efficient as and, being much cheaper, should be preferred to Socotrine aloes; the greater portion of the latter as sold to-day is made up of the former. 2. The resin of aloes is an ether or organic salt, and varies according to the kind of aloes and the varying constituents of the acid, the alcoholic constituent being aloresinotannol, and being the same in both Barbadoes and Cape aloes: the only specimens thus far examined. 3. Aloin contains emodin, to which its laxative properties are probably due. 4. Many laxative drugs beside aloes—such as senna, cascara sagrada, rhubarb, buckthorn-bark—owe their laxative property to this substance, emodin, or some substance like it, derived from anthraquinone, and homologous or isomeric with it. A. R. L. Dohme (Amer. Jour. of Pharm., No. 8, '98).

Dose.—Both varieties of aloes may be given in doses of from 1 to 5 grains as a laxative, and 10 grains as a purgative. The purified aloes (*aloës purificata*) of the U. S. P. should invariably be prescribed, since the commercial aloes contains impurities. The other official preparations of aloes are the following:—

Aqueous extract of aloes. Dose, $^1/_2$ to 5 grains.

Pill of aloes containing 2 grains of the purified aloes.

Pill of aloes and asafœtida, containing $1\,^1/_3$ grains of each drug to the pill.

Pill of aloes and iron, containing purified aloes, sulphate of iron, and aromatic powder, 1 grain of each to the pill.

Pill of aloes and mastic (Lady Webster pill), containing 2 grains of purified aloes and $^1/_2$ grain each of mastic and red rose.

Pill of aloes and myrrh, containing 2 grains of purified aloes, 1 grain of myrrh, and $^1/_2$ grain of aromatic powder per pill.

Tincture of aloes and myrrh, containing 10 per cent. purified aloes. Dose, 1 to 2 drachms.

Tincture of aloes, containing, also, 10 per cent. of purified aloes. Dose, 1 to 2 drachms.

Aloes acts slowly; it can, therefore, be given at bed-time and its effects be counted on for the next morning. It tends to cause griping; a carminative—belladonna or hyoscyamus—should, therefore, be simultaneously administered. The pill of aloes and myrrh of the U. S. P. is intended to avoid this untoward effect of aloes.

Applied to a wound in the form of powder aloes exercises its laxative action. It also acts upon a nursing infant when given to the mother.

Aloin.

Aloin is the active principle of aloes. The drug extracted from the Barbadoes aloes is identical with that taken from the species of Curaçoa and Natal. Aloin occurs in yellowish-white, acicular crystals, is soluble in hot water and alcohol, much less so in acetic ether, and sparingly soluble in chloroform, ether, and benzol.

Dose.—The dose of aloin is from $^1/_{10}$ grain to 2 grains.

Physiological Action. — The main effect of aloes is upon the large intestine, but it is likewise a cholagogue, actively promoting the flow of bile. These effects, combined, cause increase of the peristaltic action of the bowel. Aloes causes engorgement of the hæmorrhoidal blood-vessels and thus tends to render hæmorrhoids painful at the time it is used, if any be present. The other pelvic organs

—the uterus and appendages—are also congested. Hence, pregnant women should use aloes most carefully, if at all.

The active principle, aloin, acts as a powerful purgative when given by the mouth or subcutaneously. Natal aloin acts in cats and dogs only after very large quantities, but the effects are promptly produced when an alkali is added to the drug in order to decompose it. In man fed on meat exclusively aloin is very active, but not so in persons subjected to a mixed diet. Aloin in itself, therefore, has little or no purgative properties, and, in order to produce its characteristic effects, it must undergo decomposition in the intestines and a new and more active substance be formed. The slowness of its action is thus explained. (Meyer.)

Therapeutics.—It is, of course, in constipation that aloes is especially used. It is indicated when there is intestinal atony, but when its administration is prolonged it tends to aggravate the condition it is intended to counteract. Aloin possesses two advantages over aloes, namely: smaller doses and comparatively slight tendency to induce irritation in normal doses. It is usually combined with extract of belladonna and nux vomica or strychnine in small doses. An active laxative pill is thus obtained, which tends to counteract constipation without overtaxing the normal functions of the intestine.

Chlorosis.—In chlorosis aloes is usually combined with iron: the pill of aloes and iron of the U. S. P. It is best, however, not to use this pill, owing to the constipating effect of the preparation of iron utilized in it. The pyrophosphate of iron or dialyzed iron is to be preferred.

Amenorrhœa.—When this condition is due to anæmia a pill of aloes and pyrophosphate of iron is of great value. In uncomplicated cases the pill of aloes and myrrh is to be preferred, the congestive influence of the active drug tending greatly to facilitate physiological menstruation.

Hæmorrhoids.—Aloes is said by some to be valuable in this disorder, especially when due to general relaxation of the vascular system, the hæmorrhoidal veins bearing the brunt of the latter.

ALOPECIA.—From Gr., $\alpha\lambda\omega\pi\eta\xi$, **fox.**

Definition.—Partial or general falling of the hair while the pathological process is in progress.

Varieties. — Alopecia may be physiological or be due to an acute or chronic general morbid state. It may be congenital or occur as a consequence of old age. Senile alopecia, when occurring in younger individuals, without apparent lesion, is recognized as premature alopecia.

Pathological alopecias, due to a general morbid condition, may be acute or chronic.

The acute form presents itself especially during the recovery from scarlet fever, scarlatinoid erythema, small-pox, typhoid fever, and child-birth. Certain forms of rapid alopecia are due to unknown causes of nervous origin.

> Neurotic alopecia is a rare affection. Two varieties are to be noted. The partial neurotic alopecia that occurs in the area of distribution of a nerve after an injury of that structure is occasionally seen. General and complete alopecia from neurotic causes is even less common. In almost every case a severe nervous shock precedes the falling of the hair. Illustrated case. William S. Gottheil (Med. Record, Aug. 21, '97).
>
> There are two distinct forms: 1. Occipital baldness, which is common in young people, begins over the occiput, extending slowly, is rarely contagious, and is

curable. 2. Seborrhœic alopecia (of Bateman) which appears in adult and middle life. The original area is succeeded by secondary patches at some distance. It is due to a microbic infection of the seborrhœic glands, and is but slightly contagious. M. Sabouraud (Jour. des Praticiens, Sept. 29, 1900).

The chronic variety may be due either to want of care of the hair; bad cosmetics; heavy hats; poor general hygiene; lack of sleep; excesses; poor food; poor constitution; arthritism; struma; chronic poisoning (mercury); anæmia and chlorosis; diabetes; phthisis; cancer; syphilis; leprosy; in the two latter with or without visible lesions.

Alopecia may also be due to a local disease of the scalp, and occurring in that case as one of the secondary phenomena of the chief affection. The principal affections in which alopecia may thus occur are erysipelas, eczema, seborrhœic eczema, psoriasis, lichen, pityriasis rubra, pemphigus foliaceus, impetigo, acne (atrophic acne), sycosis, lupus erythematosus, and scleroderma.

In another class of affections alopecia occurs as the principal symptom, namely: seborrhœa, pityriasis capillitii, etc.; folliculitis due to drugs; keratosis pilaris; alopecia areata; tricophytosis, and favus. (Brocq.)

There are also indefinite varieties: such as the form due to a constant scratching of the head: the trichomania of Besnier.

That occurring in weak and hydrocephalic children from constant pressure of the head of the bolster.

Alopecia of the vertex in women, due to combs and hair-pins, is also classed among the indefinite varieties.

A variety of alopecia which occurs rapidly, but only temporarily, is frequently observed in connection with menstrual disturbances in women.

Symptoms. — *Congenital Alopecia.* — This form of alopecia is uncommon; it may be local or general, temporary or permanent. Keratosis pilaris and moniliform aplasia may coincide with it. It may be due to lack of development of the hair-follicles, due to backwardness in the development of the hair; or to a pathological condition occurring during intra-uterine life, ichthyosis, xeroderma, or trophoneurosis. Congenital alopecia is frequently associated with slow and late dentition.

Senile Alopecia.—Senile alopecia may begin at 45 or 50 years. The hairs first become gray, then white, dry up, and their root atrophies. They finally fall, while the scalp shows the signs of senile cutaneous atrophy.

This form usually begins at the vertex, rarely at the temples.

Senile and precocious alopecia is usually severe and progressive. It is confined to the antero-superior portion of the scalp, beginning on the top of the cranium and moving forward, leaving a little tuft of hair above the forehead. The posterior and lateral portions of the scalp preserve their hair almost, or quite, intact. Fournier (La Méd. Mod., Dec. 11, '90).

Alopecia Following Acute and Chronic General Diseases. — Though usually not marked, alopecia in these cases may be intense and general. Seborrhœa is frequently present concomitantly. The alopecia is not especially localized; it affects uniformly the scalp, thinning out the hair.

The alopecia of convalescence progresses rapidly, being produced in the course of a few weeks. It generally affects all parts of the scalp equally, and rarely results in complete baldness.

Cachectic alopecia occurs in the course of pulmonary phthisis, cancer, cirrhosis, malaria, scorbutus, diabetes, etc. It affects the entire scalp impartially. The remaining hairs are dry, lustreless, and

brittle, often breaking off before falling out. Fournier (La Méd. Mod., '90).

Syphilitic Alopecia. — This variety of alopecia is usually found in irregular thinned-out patches or streaks over almost all the scalp. The hairs are dry and their roots are atrophied; they fall out rapidly. Every degree may be observed, from simple thinning of the hair to general alopecia of the body. Some seborrhœa of the scalp is frequently present. The eyebrows are frequently thinned.

In some cases syphilitic alopecia is due to secondary or tertiary lesion of the scalp.

Syphilitic alopecia occurs in the third to the sixth month of the disease, or, rarely, in poorly treated cases, at the end of one or even two years. It comes early in the disease or not at all.

There are two forms of syphilitic alopecia: the symptomatic, accompanied either by pustulo-crustaceous, "acneiform" lesions, forming the little brownish or blackish crusts so common in the scalp from the third to the sixth month of syphilis, or, more rarely, by a very slight pityriasis-like eruption, sometimes only to be distinguished by a lens; the idiopathic, which is the most common, and which, in reality, is accompanied by a lesion. (Giovaninni and Darier.)

There is a proliferation in the hair-bulb, and the fallen hair is often found to be atrophied at its root. There is no itching, redness, nor other symptom occurring in connection with syphilitic alopecia, other than the mere falling of the hair. It is asymmetrical, affecting any locality by chance. Sometimes the fall of hair is diffused, resulting in a general thinning; at other times it occurs in patches; occasionally both forms occur together. Fournier (L'Union Méd., Dec. 4, '90).

Premature Idiopathic Alopecia.—This form of alopecia may begin early. The falling hairs are replaced by smaller hairs, which in their turn fall out, until finally only a smooth, shining scalp is left.

Frequently, besides the fringe of hair always left at the back of the head a small tuft of hair is left at the anterior portion of the scalp, just above the middle of the forehead. (Jackson.)

Two cases of alopecia universalis observed in male adults presenting the sequelæ of iridochoroiditis. In one case the ocular disease appeared subsequent to the loss of hair; in the other it preceded it by about a year. Froelich (Revue Méd. de la Suisse Rom., Dec., '90).

Case of complete generalized alopecia combined with partial anæsthesia and analgesia in a man 20 years old. Bissett (Maritime Med. News, Feb., '94).

Etiology. — Alopecia following acute and chronic general diseases is due to lesions of the hair caused by the disease, aided by neglect of the hair during illness. It occurs most frequently after typhoid fever, the eruptive fevers, especially scarlatina, and, less frequently, erysipelas. The severer phlegmonous diseases and typhus are followed by alopecia, as also occasionally severe accidents, hæmorrhages, and pregnancy. Many women lose their hair after a perfectly normal labor. (Fournier.)

All prolonged debilitating influences; excessive work, intellectual labor especially; genital excesses, overindulgence at the table, watching, and late hours may give rise to alopecia. Excessive intellectual work, however, is less likely to produce alopecia than the other forms of excess.

As regards premature idiopathic alopecia, women are less frequently affected than men. In many cases this form of alopecia seems to be hereditary.

Study of 300 cases. Conclusion that baldness is more common in men than in

women. It seems to be more common in unmarried men. Most patients are found to lead in-door lives, and belong to the intellectual class. Usually the loss of hair begins before the thirtieth year. In women it usually constitutes a general thinning; in men it affects the top of the head. Dandruff is usually a factor in the causation; heredity is also active. When complicating diseases are present, they are usually those that affect the general nutrition. G. T. Jackson (Med. Record, May 26, 1900).

Excessive mental work, excesses, and a bad hygiene of the scalp seem to be factors in its development. (Brocq.)

Pressure of the anterior temporal, posterior temporal, and occipital arteries by a stiff hat has been mentioned as a cause of this form of baldness. (F. A. King.)

The escape of the little tuft of hair above the forehead has been attributed to the fact that the supra-orbital arteries escape from pressure by their passage between the two frontal eminences. (Jackson.)

The blood-supply to the scalp is conveyed by the frontal, temporal, and occipital arteries, situated just where a tight hat would press on them and bring about a gradual starvation of the hair-follicles. A woman, on the other hand, wears her hat resting lightly on top of the head, bringing no pressure whatever on the arteries, and thus escapes baldness. The maximum of hat-pressure in a man comes on the frontal arteries, and in consequence we find baldness generally commences on the regions supplied by those vessels. M. C. Black (Indian Lancet, Apr. 16, '98).

Alopecia is a symptom resulting from many different sources of irritation of peripheral nerves. The commonest and therefore the most important of these causes is dental irritation, as shown in three hundred consecutive cases. Jacquet (Annales de Derm. et de Syph., Feb. and March, 1902).

That frequent washing of the head encourages loss of hair is the opinion of the majority of dermatologists.

Pathology. — In alopecia following acute and chronic general diseases the hairs are no longer formed; their roots become atrophied, and they finally fall out. The alopecia of convalescence is due to disturbance of nutrition of the tissues.

Premature idiopathic alopecia is due to a fibrous transformation of the derma, which strangles in its meshes the elements found in the scalp, especially the hair-follicles. As to the pathogenesis, alopecia may be considered a specific microbic affection.

The specific microbacillus of fatty seborrhœa, when introduced into the pilosebaceous follicle, produces four constant results: (*a*) sebaceous hypersecretion; (*b*) sebaceous hypertrophy; (*c*) progressive papillary atrophy; (*d*) death of the hair. These phenomena result from seborrhœic infection upon smooth regions as well as upon the hairy ones. The vertex is the seat of election of this infection. Common baldness is only a chronic fatty seborrhœa of the vertex. Not only is follicular seborrhœic infection indispensable in the production of baldness, but this seborrhœic infection remains intense, pure, and permanent until the baldness is fully and permanently established. (Sabouraud.)

Seborrhœa oleosa is due to a microbacillus which had already been discovered, but not rightly interpreted by Unna. This microbacillus forms a mass in the upper third of the hair-follicle, between the surface of the skin and the point where the sebaceous gland opens into the follicle. This mass is the oily cylinder which may be extracted from the follicle by pressure on the skin. Secondary infections may be superadded to seborrhœa of the face, giving rise to acne or furunculosis. On the scalp it causes seborrhœic alopecia.

Ordinary alopecia areata is closely related to seborrhœa. Any patch of alo-

pecia areata is the seat of an intense localized seborrhœic infection, both previous to the loss of hair and while the latter persist.

In chronic alopecia areata the infection of the hair-follicle is a permanent one; acute alopecia areata is a localized acute seborrhœa; alopecia decalvans is a general chronic seborrhœa. R. Sabouraud (Ann. de l'Inst. Past., Feb., '97).

Alopecia probably due to autoinfection, the poison—"trichotoxicon"—being absorbed by the blood from the air-vesicles of the lungs. The poison would then be elaborated during decomposition of organic matter normally present in respired air. Parker (Med. Record, July 13, 1901).

These opinions of Sabouraud are not at present accepted by dermatologists generally.

Prognosis. — In senile alopecia the prognosis is unfavorable, the chances of cure being practically *nil.*

In alopecia following acute general diseases, on the contrary, the prognosis is generally good, and the hair soon recovers its former state, though in some cases seborrhœa persists and requires careful treatment to prevent relapse of the alopecia.

In serious chronic diseases, however, such as phthisis or cancer, the prognosis is unfavorable.

The alopecia of convalescence is temporary and reparable; entire repair of the loss occurring in young people; after forty years of age the hair is rarely reproduced in its integrity. Fournier (La Méd. Mod., Dec. 11, '90).

[By no means is this always the case in youth in my experience. A. Van Harlingen, Assoc. Ed., Annual, '92.]

Syphilitic alopecia, when not due to a local lesion, is only temporary and is soon recovered from by an appropriate specific and hygienic treatment. When due to a local lesion the alopecia may be incurable if the hair-follicle has been destroyed.

Syphilis never causes permanent and complete baldness. Properly treated, it is accompanied by extensive alopecia in only one case in twenty. Fournier (L'Union Méd., Dec. 4, '90).

Premature idiopathic alopecia is usually looked upon as beyond treatment.

Treatment. — *Premature Idiopathic, Senile, and Congenital Alopecia.* — In these varieties general treatment is of importance. Arsenic and iron, continued for a long time and in small doses, alternately, should precede all the methods resorted to. (E. Besnier.)

A tonic treatment should be given where the nervous system seems to be at fault. The following pill should be taken thrice daily:—

℞ Strychnine sulphate, $^1/_{30}$ grain.
Reduced iron,
Quinine bisulphate, of each, 1 grain.
For one capsule.

When starvation of the nerves seems to be present, the compound syrup of the hypophosphites (Fellows's) is ordered in 1-drachm doses, thrice daily, with $^1/_{30}$ grain sulphate of strychnia in each dose. Doses of $^1/_8$ to $^1/_6$ grain of muriate of pilocarpine in a powder, daily, at bedtime, in water, are also of use. Ohmann-Dumesnil (New Orleans Med. and Surg. Jour., July, 92).

Mercuric bichloride or calomel internally, alternately with tincture of ignatia amara, 30 drops daily in three doses, or sulphurous acid, internally, are also recommended. (Shoemaker.)

Excesses of any nature should be refrained from, and any habit or occupation tending to depress the general vital process be counteracted.

Resorcin is of great service in the treatment of alopecia. (Bulkley.)

Brocq recommends the following methods of using this remedy:—

℞ Resorcin, $1\,^1/_2$ grains.
Hydrochlorate of quinine, 3 grains.
Pure vaselin, 1 ounce.

This is to be applied to that part of the scalp which is devoid of hair or from which the hair is rapidly falling. If the falling of the hair persists it is well to incorporate with it 5 to 15 minims of the tincture of cantharides, or to use the following:—

℞ Resorcin, 3 grains.
Hydrochlorate of quinine, 5 grains.
Precipitated sulphur, 30 grains.
Pure vaselin, 1 ounce.

Should these preparations produce much irritation of the scalp, an ointment composed of 20 grains of borax to 100 of vaselin should be applied. After the irritation is relieved, weaker preparations of resorcin and quinine can be employed, of which the following is an example:—

℞ Salicylic acid, 5 grains.
Resorcin, 3 grains.
Hydrochlorate of quinine, 5 grains.
Precipitated sulphur, 30 grains.
Pure vaselin, 1 ounce.

Should the falling of the hair be associated with seborrhœic eczema, a mercurial ointment, such as that of yellow oxide of mercury, varying in strength from 1 in 25 to 1 in 10, according to the severity of the trouble, should be used. This is only to be rubbed upon isolated patches at a time. After it has been employed and an alterative effect upon the skin produced, resorcin may again be resorted to:—

℞ Resorcin, 4 grains.
Salicylic acid, 7 grains.
Pure vaselin, 1 ounce.

When the scalp is excessively greasy the ointment previously employed and the natural oil of the skin should be removed by washing the scalp with a weak solution of ammonium acetate or by using Castile soap and warm water. Under no circumstances should the oily preparations be used continuously without occasional cleansing of the scalp. (Brocq.)

> The general treatment of seborrhœa includes sulphur, iodine, and arsenic. Locally, seborrhœa may be much improved, but, according to Sabouraud, not actually cured. In order to eradicate it, it would be necessary to expel all the bacillary colonies in the skin. In order of merit for local application Sabouraud places sulphur, tar, and mercury. Drugs such as salicylic, tartaric, and acetic acids are useful as mordants to aid penetration. Of the tar preparations the oil of cade preferred. Pyrogallic acid and chrysophanic acid are useful, and the former may be replaced by hydroquinone, which does not stain. Mercury is best applied in the form of cinnabar or yellow oxide. Sabouraud does not place much reliance on medicated soaps, because they are washed off too soon for the drug to have much effect. Marshall (Treatment, May, 1904).

The following lotion sometimes proves beneficial at the beginning of the affection:—

℞ Acetic acid, $^1/_2$ ounce.
Pulverized borax, 1 drachm.
Glycerin, 3 drachms.
Alcohol at 60°, $^1/_2$ ounce.
Rose-water, $^1/_2$ pint.

Another procedure that proves occasionally effective is to rub the scalp lightly twice or thrice weekly, for three or five minutes, with a soft brush or sponge dipped in

℞ Sodium bicarbonate, 1 drachm.
Distilled water, 5 ounces.

A small amount of oil is to be put upon the hair the first or second day following each of the above applications. (Pincus.)

The head may be washed with the

yelks of eggs, or white almond-oil soap or with tar-naphthol or ichthyol soap, according to the degree of tolerance of the scalp.

Any alcoholic preparation to which has been added a small amount of tincture of cantharides, tincture of nux vomica, acetic acid, salicylic acid, or citric acid, from $^1/_2$ to 5 per cent., is recommended by Besnier and Doyon. It is applied with a piece of absorbent cotton after carefully drying the scalp.

The tinctura saponis viridis, often used to shampoo the scalp, is sometimes too strong. An ordinary soda-soap, made by dissolving about 1 ounce in 1 pint of water, and adding some soda or potassa, may be used instead. When the scalp is cleansed, 1 part of benzol (from coal-tar), mixed with 10 parts of alcohol, is to be applied.

If this fails a 1- to 3-per-cent. alcoholic solution of naphthol, or the following formula may be used:—

℞ Resorcin, 5 parts.
Alcohol, 150 parts.
Castor-oil, 2 parts.

Other formulæ of value are:—

℞ Quinine sulphate, 1 part.
Alcohol, 60 parts.
Cologne-water, 1 part.

Either of these may be applied locally, after carefully washing the scalp.

After cutting the hair short and washing with soap the following lotion is applied. Perchloride of mercury, $^1/_5$ part; acetic acid, 1 part; alcohol, 100 parts; ether and alcoholic solution of lavender, of each, 50 parts. After drying the head is rubbed with lactic acid, about 30 per cent. Balzer (Jour. des Pratic., Aug. 24, 1901).

Alopecia Following Acute and Chronic General Diseases. — Any general treatment appropriate to the primary disease naturally tends to improve the local process. A tonic treatment further assists the curative efforts.

After careful brushing out of the hair the head should be washed with a decoction of saponaria, or three yelks of eggs beaten up with one part of lime-water, or with warm water and good soap, and then carefully dried. This should be followed by the following lotion rubbed in daily:—

℞ Alcohol at 80°, 2 $^1/_2$ ounces.
Camphorated alcohol,
Rum,
Tincture of cantharides,
Glycerin, of each, 75 minims.
Santal-wood essence,
Wintergreen-essence, of each, 5 minims.
Pilocarpine hydrochlorate, 7 $^1/_2$ grains.

This is to be rubbed in lightly once daily.

Any exciting application containing rum or camphorated alcohol with spirit of rosemary—and to which may be added quinine, in the proportion of 4 to 30 of either tincture of nux vomica, tincture of capsicum, or tincture of cantharides—may be employed.

If the hair be very dry some almond-oil or castor-oil may be applied from time to time.

Prevention through massage-exercise is nine points in the law of treatment of baldness. This should be begun in early life, at the time when the youth is developing into the more sober man, when his occipito-frontalis muscle has become more and more subordinated to his will. Massage should be performed the same way as in other regions, first freeing the vessels farthest from the seat of trouble, and gradually approaching the centre. It should be done at night as well as in the morning, particularly at night, as gravity has little, or comparatively little, chance through the day. If the scalps of men received enough exercise as the scalps of women, there should be on the vaults of their craniums a luxuriant tonsure. George Elliott (Dominion Med. Monthly, March, 1902).

It is well to keep the hair cut short until it begins to grow again.

Universal alopecia arrested in a case by thyroid extract, 5-grain tabloids three times a day. H. R. Beevor (Brit. Med. Jour., July 13, '95).

[I cannot too strongly warn the reader against placing too great confidence in the marvelous results obtained recently in numerous dermatoses from the thyroid treatment. The subject requires considerable control study before these results can be accepted. L. Brocq, Assoc. Ed., Annual, '96.]

The influence of thyroid extract shown in the case of a woman, aged 66 years, suffering from myxœdema, in whom the growth of hair during fifteen months was striking (see wood-cuts). Does not the remarkable influence of thyroid extract upon hair-growth suggest that the thyroid gland in its function is largely occupied with nutrition of the skin? Thomas F. Raven (Brit. Med. Jour., July 31, '97).

Syphilitic Alopecia. — The best treatment consists in early and thorough antisyphilitic measures. Local treatment is not really necessary, but, if applied, should consist in lotions containing mercuric perchloride, 1 to 500 or 1 to 1000, or ointments containing either yellow oxide or sulphate of mercury. (Brocq.)

The following treatment is recommended by E. Besnier:—

1. Cut the hair short.

2. Wash the scalp with soap and warm water every morning.

3. Apply the following ointment:—

℞ Salicylic acid, 75 grains.
Precipitated sulphur, $2^1/_2$ drachms.
Lanolin,
Vaselin, of each, 1 ounce and 6 drachms.

Every evening rub in with a soft brush the following lotion:—

℞ Spirit of rosemary, $3^1/_2$ ounces.
Cantharides tincture, $2^1/_2$ drachms,
or salicylic acid, 15 grains.

Influence of thyroid extract upon hair-growth and general appearance in myxœdema. The same patient, a woman aged 66, as she appeared before treatment and as she appeared after taking two thyroid tabloids daily for fifteen months. (*T. F. Raven.*)

Syphilitic alopecia is easily curable by the internal use of mercury. Local applications are useless. Fournier (L'Union Méd., Dec. 4, '90).

[Here I must differ from Fournier; local applications are valuable adjuvants. A. Van Harlingen, Assoc. Ed., Annual, '92.]

George H. Rohé (Baltimore) and Central Staff (Philadelphia).

ALOPECIA AREATA.

Definition. — A disease of the hair characterized by the rapid development of more or less circular or oval bald patches on the scalp and sometimes in other parts of the body.

Symptoms. — Alopecia areata usually presents itself in the form of rounded

or oval patches, situated on the scalp or other hairy regions of the body. The skin of these patches is white and smooth, and in some cases discolored and somewhat depressed. At times the affection extends over the entire cutaneous surface.

The hairs become dry and colorless, their roots are atrophied, and they rapidly fall out.

Three main forms of alopecia areata have been recognized: alopecia areata achromatica (Bazin), in which the bald patches are discolored and excavated, as described above; false alopecia areata, in which the patches of baldness are more or less covered with thin, brittle hairs, which can easily be pulled out along with their roots: a form of ringworm. The third variety is alopecia areata decalvans, in which the entire scalp, or the skin of other parts of the body, becomes bald in a few days, the hair falling with great rapidity.

In alopecia areata the hairs are dry, lustreless, thin, and brittle. Their roots are either atrophied and thread-like or swollen into irregular nodules. The medulla has disappeared, and air-bubbles may be seen in their interior. They frequently break close to the scalp, their free extremity being brush-like in appearance.

In the so-called false alopecia areata the few hairs left retain their hue and consistency.

Deductions based on a study of 257 cases:—

Four classes of cases are included under the generic name alopecia areata:

1. Universal alopecia; it is very rare.

2. Baldness occurring in one or more patches at the site of an injury or in the course of a recognizable nerve. This is comparatively infrequent.

3. A form first described by Neumann as "alopecia circumscripta seu orbicularis." The patches are small, from lentil- to pea- size, much depressed below the surface, with often a marked decrease of the sensibility. The prognosis is unfavorable.

The first three classes form less than 10 per cent. of all the cases classed as alopecia areata. They are undoubtedly of trophoneurotic origin.

4. The largest, numerically, is due to a vegetable parasite. Crocker (Lancet, Feb. 28, Mar. 7, '91).

Two cases in which the nails were affected in patients suffering from alopecia areata of the scalp. One was a delicate nervous young woman. The nails became affected some months after alopecia had manifested itself on her scalp. The second case was that of a young man who had a typical patch of alopecia areata on the scalp. The nails in both cases presented a discolored granite-like appearance due to minute punctiform depressions, which gave them a dirty, unpolished look. C. Audry (Jour. des Malad. Cutan. et Syph., Mar., 1900).

Diagnosis.—Alopecia areata should be distinguished from *syphilitic alopecia*; but usually in this latter affection the patches are merely thinned out and arranged irregularly over the head in streaks; other symptoms of syphilis are frequently present.

The alopecia in patches resembles, in a certain way, alopecia areata, but it has certain characters which are perfectly pathognomonic. Alopecia areata makes a clean sweep, all the hairs on the patch falling out. In syphilis, however, some hairs always remain on the affected patches, which also are never so regular, rounded, or extensive as those of alopecia areata. Another diagnostic point is that the area-like alopecia of syphilis is always accompanied by the disseminate form, whereas in alopecia areata the hair is usually normal up to the very edge of the bald spot. Finally, alopecia areata decolorizes the skin, which becomes dead-white, while the bald areas of syphilis retain their natural color. Fournier (L'Union Méd., Dec. 4, '90).

Premature Idiopathic Alopecia.—From ordinary alopecia, alopecia areata should

be recognized by its white, smooth appearance and rounded, limited form.

Heredity plays a small part in producing early alopecia. Only four incontestable instances were found in over three hundred cases treated. Over 90 per cent. are due to the one disease: eczema seborrhœicum. Two varieties of diplococci isolated, both of which inoculated upon healthy subjects produced lesions characteristic of the disease. One was a non-chromogenic organism which produced pityriasic manifestations; the other, chromogenic, produced lesions covered with yellowish, greasy scales. Both together cause greasy, crumbling scales. Elliot (Amer. Derm. Assoc., Sept. 17 to 19, '95).

Trichophytosis.—Microscopical examination in this disease shows at once that no distinct parasite is found in alopecia areata, while in trichophytosis the hair is filled with spores. The hairs, when seized with forceps, become crushed, while they do not yield in alopecia areata.

Case of a boy presenting a perfectly bald spot about two inches in diameter on the top of the head, with the typical features and hair of alopecia areata. It had begun, however, as a scaly patch. Microscopical examination showing the presence of spores, it was pronounced to be trichophyton by Bulkley. Whitehouse (Jour. Cut. and Genito-Urin. Dis., Oct., '93).

Etiology. — In the great majority of cases alopecia areata occurs as a result of contagion. This has been fully demonstrated clinically and experimentally. The implements of the hair-dresser are almost the only agents of transmission of contagion, doubtless because they alone can cause the abrasions necessary for sowing the organism with which contamination occurs. This explains why alopecia areata seems, at first sight, to be a sporadic affection in cities, and why in colleges and barracks it may take the shape of an epidemic. Every disease propagated from one individual to another supposes an active cause capable of multiplication and reproduction: that is to say, a living pathogenic parasite.

Conviction expressed that alopecia areata is contagious under certain circumstances. Lassar (Phila. Med. Jour., Apr. 16, '98).

Two epidemics of alopecia areata in an institution for homeless girls between the ages of 3 and 14 years. The first case occurred in a girl, 11 years old, who, when first seen, presented three round, bald patches upon the crown of the head, clinically typical of alopecia areata. Several weeks later another girl was found to have a bald patch upon the crown, which increased rapidly in size for a time. Four months after the discovery of the first case a large number of the girls in the asylum were suddenly found to be affected. After cutting the hair of all the children it was found that 63 of the 69 girls had bald areas upon the scalp. One girl, who had just entered the institution, acquired a patch in three days. After two months the disease appeared to come to a stand-still; at the end of six months almost all the bald patches were covered with hair. No trace of micro-organism was found. No adult inmate of the asylum was attacked. Bowen (Jour. Cutan. and Genito-Urin. Dis., Sept., '99).

Alopecia areata may also be caused by shock, worry, overwork, traumatisms, or epileptic paroxysms.

Case following prostration through shock, continued until there was complete denudations of hairy portions of the body. Morton (Brooklyn Med. Jour., Sept., '95).

Two instances of alopecia areata occurring in epileptics after paroxysms, in which the neurotic rather than the parasitic origin seems the more probable. The hairs finally recovered their thickness, volume, and color. In both cases alike the evolution of the lesions was not interfered with by any medical intervention, either general or local. Féré (La Nouv. Iconog. de la Salpêtrière, '95).

The neurotic theory of the origin of alopecia areata is still held by many dermatologists.

Jacquet attributes many cases of this form of baldness to dental irritation. While this has not been confirmed, there is much that points to the correctness of the deduction. At the same time it does not exclude a bacterial invasion in certain cases, as demonstrated by Sabouraud. The observations of Jacquet lend strong support to the view that peripheral irritation from whatever cause may give rise to this form of baldness. The writer has observed and published in abstract an account of four cases in which alopecia areata seemed to be due to eyestrain—at least the condition was relieved by fitting the patient with proper glasses. Acting upon this hint the writer has tested a large number of cases of children with alopecia areata. In one or two cases marked error was found, but in the majority the eyes were evidently not the cause of the trouble. While he does not claim to have discovered a widely operative cause of alopecia areata, he still thinks there may be a number of cases in which this affection is initiated and perpetuated by uncorrected eyestrain. A. Whitfield (Lancet, March 5, 1904).

Prolonged exposure to the vacuum-tube of an x-ray apparatus may give rise to localized falling of hair.

Case of dermatitis and alopecia after the use of the Roentgen rays in a young man, aged 17, in whom experiments were carried out during four weeks, once or twice each day. The dermatitis resembled that caused by burns. An improvement soon occurred. Marcuse (Deutsche med. Woch., July 23, '96).

Case of alopecia areata as a result of exposure to the Roentgen rays during forty minutes, using a Thompson double-focus or standard vacuum-tube. The distance between the tube and skull was a little over eighteen inches. A large area of hair missing upon that side of the head exposed to the vacuum-tube; no premonitory symptoms of itching or inflammation; the hair had suddenly fallen out three weeks after the exposure.

The integument appeared bald and somewhat elevated, and slightly œdematous; no redness; sensibility not impaired; no scaling. Under stimulating and hygienic treatment downy hairs are beginning to show themselves. F. S. Kolle (Buffalo Med. and Surg. Jour., Dec., '96).

True alopecia areata seems to occur in syphilitic subjects more frequently than in other persons.

Areas of absolute alopecia which occur in the scalp or beard in syphilis may be small and few, well circumscribed, lasting a short time, but recurring often. This is very different from that general thinning of the hair seen early in the disease, which never returns. A Fournier (Jour. des Praticiens, Jan. 19, 1901).

The percentage of alopecia areata in various countries is approximately as follows: France, 3 per cent.; England, 2; Scotland, 1.5; Vienna, 0.75; North Germany, 0.75 to 1; America, 0.5. (Crocker.)

In Lille, of 5000 cases of skin disease, 149 cases were alopecia areata; in Lyons, of 2765 cases, 17; in Vienna, of 5000, 40; in Berlin, of 1050, 9; and in another series of 3008 cases, 30 were alopecia areata. In America, as shown by the statistics of the American Dermatological Association, alopecia areata was found in 794 cases out of 123,746 cases. E. Besnier ("Sur la Pelade," Travail lu à l'Acad. de Méd., July 31, '88).

Pathology. — The initial stage alone of ordinary benign alopecia areata is microbic. As soon as the patch becomes smooth, microbes can no longer be found, neither in the skin nor in the follicle. In the beginning of the disease almost all the follicles are infected with innumerable microbian colonies belonging to a single bacillary species always the same.

In benign cases the follicular infec-

tion is transitory; in chronic or total alopecias the same microbe is found constantly, with the same localizations.

The invariable presence of this microbe wherever there is a beginning lesion gives it a value other than that of an ordinary secondary infection. However, this microbacillus, notwithstanding certain differences of form, cannot be distinguished with absolute certainty from the microbe which Hodara has described as the bacillus of acne. If the bacillus of Hodara and that of alopecia areata are the same, we must ascertain why in every case of alopecia this secondary infection is constant, and what rôle it plays. If they are different, they must be differentiated experimentally. Finally, they may be the same bacilli which, under different vital conditions, may or may not secrete a toxin capable of producing alopecia. (Brocq.)

According to Sabouraud, alopecia and alopecia areata are practically identical. The patch of alopecia areata is only an attack of acute circinated seborrhœa: in other words, the bald only become bald by a diffused process of chronic alopecia areata. Alopecia areata is a contagious disease, the extension of which is marked by the appearance of a special form of hair: the club-shaped hair. This hair appears with the disease, disappears at the same time that it ceases to extend, and reappears with the renewal of activity. Where the malady is active it is never wanting.

The microscopical examination of the club-shaped hair shows that its special form is due to a progressive atrophy of the papilla which forms it. A histological examination will separate alopecia areata clearly from the cryptogamic tineas.

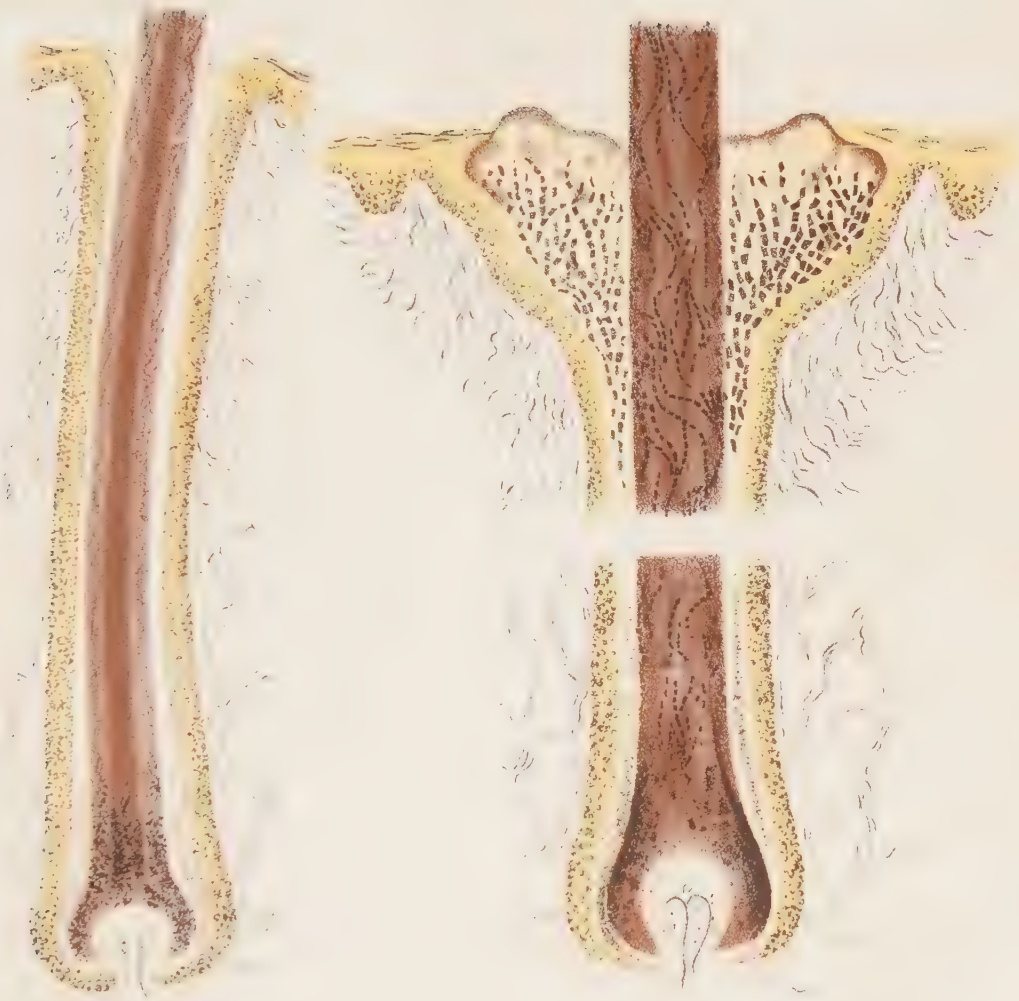
In 300 cases examined by him, Sabouraud found that all the morbid conditions indicate a pre-existent intoxication, the cause of which had disappeared. In the earlier stages, however, he found that one out of every two or three follicles at the margin showed an ampulliform dilatation at its upper part, which he calls the utricle. (*See colored plate.*) This, when first perceptible, is roofed by a dome having a minute window in its centre. In this cavity alone the microorganism is to be found. So long as the aperture remains closed the microbacillus exists in a pure state, but when it opens it disappears, and saprophytic fungi enter. The bacillus is one of the smallest known, and is in innumerable numbers. It is, according to him, constant in the early stage of the benign form. In total alopecia of this type there seem to be two stages: in one the bald skin is oily and shining, and in the second it is dry and rather scaly, and in which there is a tendency to restoration of hair. If, in the seborrhœic stage, the contents of the follicles are expressed by massage, the same organisms found in the utricle are recognizable in immense numbers, less numerous in the drier stage, and not to be found when healthy lanugo hairs begin to clothe the surface. Sabouraud hesitates to pronounce the microbe he has discovered as the causal element, for one both identical in appearance and in reaction to stains has been found habitually in the comedo and in seborrhœa of the oily type.

The microbes which are found in the hair are diverse; they are habitually observed even upon scalps that are not affected with alopecia, but only in hairs which show evidence of papillary alteration anterior to the microbic invasion.

Indeed, none of these microbes, almost all of which have been described by various authors as specific, can, according to Sabouraud, have any causal importance in the disease.

Fig. 1.

Fig. 2.



Alopecia Areata. (Sabouraud.)

Figure 1. Section of normal hair, implanted portion. Figure 2. Section of hair showing the peladic utricle.

Prognosis.—The prognosis of alopecia areata is exceedingly variable; in many cases treatment must be continued for years.

The more ancient the patch is, the more difficult it is to promote a return of the hair.

Occipital or temporal alopecia areata recovers more slowly than that of other regions of the scalp.

When the hairs begin to grow anew they are frequently white at first, and only later, by the continuance of the treatment, do they resume their normal hue.

Treatment. — The general treatment usually recommended has for its object to strengthen the patient. Increased nutrition and general tonics play an important part in the methods indicated. Country-air, physical exercise, rest from mental overwork, warm sulphur shower-baths (Besnier and Doyon), cold shower-baths on the vertebral column, iodide of iron, codliver-oil, strychnine, sodium arsenate, the preparations of cinchona, and the valerianates have each their sponsors.

Food containing much butter, fat and milk, phosphates and fish, strychnine, and phosphoric acid are of service.

The progress of the disease must be arrested by shaving the hair around each patch for about half an inch or, even better, by shaving the entire head. Epilation may be done, instead of shaving, around the bald patches. (Brocq.)

Alopecia areata develops by preference on a nervous soil. General treatment is hence important, and sea air, exercise, massage, etc., are recommended. Internally arsenic and phosphates are useful. Locally epilation around the periphery of the patches, as it causes a slight irritation of the skin. Acetic acid is applied to the bald places either pure or diluted as follows: Ether, 25; hydrate of chloral, 1 to 4; acetic acid, ½ to 2 parts. The author also uses pencils of chrysarobin made up with paraffin, cacao, and vaselin. In rebellious cases a blister may be used, followed by the application of silver nitrate. In addition to the local treatment the whole scalp may be treated by friction with the following lotion: Alcohol (90 per cent.), 300 grammes; alcohol of lavender, 100; bichloride of mercury, 0.6 centigramme; tincture of cantharides, 15; hydrate of chloral, 5; castor oil, 2 grammes. Other methods, such as massage, faradization, high-frequency currents, and light treatment have been tried, but simply act in the same way by causing irritation. Charmeil (Echo Méd. du Nord, p. 345, 1903).

To effectively treat alopecia areata, it is necessary to act upon the derma, and the horny layer must first be destroyed by the application of a vesicating fluid, preferably the ethereal solution of cantharides. On the following day a 15-per-cent. solution of nitrate of silver is applied upon the denuded chorium, with or without previous cocaine anæsthesia. This may be renewed in ten or fifteen days if necessary. The results of this treatment greatly surpass in effectiveness those following other procedures. (Sabouraud.)

The success of epilating a ring of hairs in the early stage as a means of protective demarkation against extension is explained, if Sabouraud's discovery should be verified.

In facial alopecia areata rubbing of the affected region daily with tincture of cantharides, either pure or mixed with spirit of rosemary, according to the irritability of the skin, is another valuable measure.

℞ Tincture of cantharides, 1 ounce.
Spirit of rosemary, 2 drachms to 1 ounce.

The hair should be cut short. Van Swieten's solution rubbed in, and each diseased patch painted with a thick coat-

ing of 1 part of iodine to 30 of collodion. At the end of a week this film loosens and begins to separate. Frictions with the sublimate solution are then used, morning and evening, until all the remaining pellicles of collodion have been removed, when a new coating of iodized collodion is applied. After three applications the downy, new hairs begin to appear. Tison (Jour. de Méd., Apr. 24, '92).

Antiseptic preparations have been recommended by a large number of authorities.

In parasitic alopecia areata (trichophytosis) the hair is cut close, and a solution of corrosive sublimate (1 to 750) or, preferably,—on account of its non-toxic qualities,—a 3-per-cent. solution of creolin is applied. This is used all over the scalp as a preventive. Sapo viridis is rubbed into the affected areas, and allowed to remain on for five minutes. After washing this off, a small quantity of the following ointment is rubbed in:—

℞ Hydrarg. bichlor., 1 grain.
Lanolin, 1 ounce.

To be thoroughly mixed.

The latter should be applied twice daily, as a usual thing, but sometimes a less frequent application suffices.

In neurotic alopecia areata the same internal treatment is used as in presenile alopecia. Externally, in some cases, cantharidal collodion is applied to the affected area, and, after vesication has been established, a dressing of some bland ointment. As the collodion varies in its effect, it is to be applied at greater or less intervals.

Bulkley's method, with some modifications, is as follows: The pure carbolic acid is applied twice a week, and over the entire area of the patch, however large, by freely swabbing. Those portions which are affected by the acid turn milky white in a few moments, and, if they do not do this, are touched again after awhile. If the parts that turn white show any very marked inflammatory action, they are passed over at the next sitting. Generally, however, there is, at most, but a slight amount of desquamation. (Ohmann-Dumesnil.)

Successful treatment of alopecia areata by means of lactic acid, applied gradually in increasing strengths, beginning with a 50-per-cent. solution. Ristema (Brit. Jour. of Derm., July, '98).

A 50-per-cent. aqueous solution of lactic acid has a remarkable effect in alopecia areata. As the remedy is quite irritating, it should not be used more than once a day. If the pain should be very severe the acid is to be suspended temporarily and anodyne applications used. In the large majority of cases cure was complete in three months. Stojanovitch (Ann. de Dermat. et de Syph., Sept., '99).

The local use of strong solutions of carbolic acid has been advocated by Duhring and Bulkley.

Three cases cured in five weeks by painting the patches with iodized collodion, 1 to 30. It is supposed that the impervious coating formed by the collodion kills the micro-organism. Chatelain (Revue Gén. de Clin. et de Thér., Dec. 31, '90).

The scalp is thoroughly washed for ten minutes with tar-soap, first using hot water, then cold. The parts having been thoroughly dried, a solution of bichloride of mercury, 1 to 900 (equal parts of water, glycerin, and cologne), is rubbed in. The scalp is then anointed with a pomade containing

℞ Salicylic acid, 2 parts.
Tincture of benzoin, 10 parts.
Neat's-foot oil, 100 parts.—M.

This treatment should be carried out daily and continued for six weeks or more. Lassar and Groetzer (Brit. Jour. of Derm., Feb., '91).

A 95-per-cent. solution of carbolic acid

is applied to the affected region and its periphery. It is somewhat painful at first. The skin whitens, shrivels, and desquamates. In two weeks second application may be made. Bulkley (Jour. Cut. and Genito-Urin. Dis., Feb., '92).

Tricresol is a very efficient remedy for alopecia areata. In nine cases an average cure was obtained in two and one-half months. The area should be thoroughly cleansed with benzin, and then tricresol applied pure to the scalp. It is well rubbed into the denuded patches and into roots of hairs one-half inch beyond each patch, by the friction of a small swab of cotton tightly wrapped on a wooden tooth-pick. The burning and pain soon pass away. These applications are made according to the local effect produced, but on the average every five to seven days till desired result be obtained. Granville MacGowan (Pacific Med. Jour., Aug., '99).

The methods advocated by Besnier and Doyon are much employed on the continent of Europe.

Every morning the head is washed with warm water and tar-, ichthyol-, or naphthol- soap, followed by rubbing in a weak alcoholic liniment:—

℞ Spirit of lavender, 4 ounces.
Salol or salicylic acid, 7 1/2 grains.
—M.

Every evening the following ointment should be applied:—

℞ Peruvian balsam
Salicylic acid,
Resorcin, of each, 15 grains.
Precipitated sulphur, 2 1/2 drachms.
Lanolin,
Vaselin, of each, 14 drachms.

Every morning the patches and their immediate neighborhood should be lightly rubbed with a piece of absorbent cotton dipped in the following solution:

℞ Chloral-hydrate, 4 scruples.
Ether, 7 drachms.
Crystallized acetic acid, 15 to 60 grains.—M.

Or in a mixture of acetic acid and chloroform varying in strength according to the susceptibility of the patient.

If the face be affected, it should be washed every morning with warm water to which a small quantity of one of the antiparasitic solutions mentioned above has been added.

When the trunk and limbs are affected the treatment should consist in sulphur, salt, with electric baths, and in rubbing the body with a horse-hair brush dipped in a stimulating liquid:—

℞ Resorcin, 2 drachms.
Orange-flower water, 12 ounces.—M.

Morrow recommends the following procedures:—

Constitutional means of improving the general nutrition are at once begun. The hair is clipped around the affected patches, the loose hairs are removed, and the following preparations are then applied:—

℞ Chrysarobin, 20 to 40 grains.
With or without
Salicylic acid, 10 to 15 grains.
Ointment of gutta-percha, 1 ounce.

A moderate dermatitis should be excited and maintained.

When the alopecia is severe and extensive the scalp is shaved and acetic acid is applied in greater or less proportion, mixed with equal parts of chloroform or ether, producing a superficial vesiculation followed by desquamation.

Between the applications the bald spots are anointed with a stimulating oil:—

℞ Eucalyptus,
Turpentine, of each, 1/2 ounce.
Crude petroleum,
Alcohol, of each, 1 ounce.—M.

This is followed by a thorough massage of the scalp by the patient. Once a

week or oftener the scalp is thoroughly shampooed with tincture of green soap. At a later stage sulphur and resorcin ointments and salt-water douches may be used.

For the face weaker solutions of acetic acid should be employed, or applications of a mixture of equal parts of tincture of capsicum or tincture of cantharides and glycerin be made. For the body mercurial and tar- soaps and sulphur-baths are to be used.

Chrysarobin is the best remedy, prepared as follows: A stick composed of

℞ Chrysarobin, 30 parts;
Resin, 5 parts;
Yellow ointment, 35 parts;
Olive-oil, 30 parts;

is rubbed every evening over the affected part, which is washed clean with olive-oil in the morning. In some days the skin becomes irritable and red, when zinc ointment is substituted for a time. Leistikow (Ther. Monat., Jan., '94).

The following treatment has given the most satisfactory results: Every night for one week the affected spots should have well rubbed into them an ointment of chrysarobin, of a strength of from 20 grains to 2 drachms of the drug to 1 ounce of petrolatum. If the disease is not checked this treatment should be repeated. After the disease has stopped spreading, precipitated sulphur ointment (from 1 to 2 drachms to the ounce) should be used. Severe or chronic cases may call for other measures. Dillingham (Amer. Med., March 12, 1904).

Pilocarpine, locally and internally, has been recommended, but this agent is expensive: a fact militating against its use in ointments.

The following ointment is highly recommended:—

℞ Pilocarpine,
Quinine, of each, 4 parts.
Precipitated sulphur, 10 parts.
Balsam of Peru, 20 parts.
Beef-marrow, 100 parts.—M.

Sabouraud (Concours Méd., June 19, '97).

Pilocarpine acts not only in increasing perspiration, but produces also marked and persistent vasodilatation, which increases the nutrition of the hair-bulb. He employs the nitrate in solution of $^1/_2$ per cent., mixed with 1 to 1000 bichloride of mercury, by intradermic injection. Before injecting the plaque is rubbed with 90-per-cent. alcohol. The syringe is filled three-quarters full by drawing in first $^1/_4$ cubic centimetre of the mercurial solution, then $^1/_4$ cubic centimetre of the pilocarpine solution, and finally $^1/_4$ cubic centimetre of the mercurial solution. This makes the proper proportion. The injections are made just beneath the skin in as horizontal a manner as possible, 1 centimetre apart, and repeated every four or five days. A patch the size of a dollar requires about 12 injections. After four or five sittings the hair begins to grow. In sixty cases treated over a period of three years there was no instance of failure. Scheffer (La Méd. Mod., May 19, 1900).

Resorcin has given satisfactory results in the early stages.

Electricity is sometimes of value. The negative pole of a battery of from four to ten cells should be applied to the bald spot sufficiently long to produce a redness of the skin. It should be used only in connection with other remedies. (Hayes.)

An ointment of chrysarobin, from 3 to 10 per cent. in strength, can be recommended as an effective application. In prescribing this the physician must not forget to mention the fact that it will stain the bed-linen, and caution the patient not to get any ointment in his eyes lest a severe conjunctivitis result. George Henry Fox (Amer. Jour. of Obst., Jan., '96).

Treatment by the arc light, the bald spots and their shaved borders being subjected to daily treatment of an hour and a quarter's duration. The number of sittings varied in accordance with the size and number of the spots. The results were good, the hair beginning to grow in a short time. In one case two or three bald spots were treated with

the light; these became completely covered with hair, while the untreated spots remained hairless until treated later in the same manner. Jersild (Annales de Dermat. et de Syph., Jan., '99).

Case of a successful cure in four months by x-rays. The patient, a male aged 18, suffered from several patches for five months. The patches varied in size from a pea to an egg. As a control experiment one patch was not treated by the rays, but an area covering the other patches, together with the healthy scalp, was exposed for a total period of two hours, made up of frequent short exposures. A week after exposure the hair fell off all the exposed parts. In three weeks the alopecia areas became red; the normal areas were bald, but not red. In another month there was a growth of new hair on the alopecia spots, while the rest of the scalp remained bald. The condition was thus the reverse of that at the beginning of treatment. After four months' treatment the whole area exposed was covered with hair; the untreated patch, however, was still bald. This was afterward cured. The author does not consider the effect due to bactericidal action, as he finds that exposure of bacteria to the strongest rays at a focal fifteen centimetres for an hour only hinders their growth for a time. The same exposure to the scalp would cause severe ulceration. Holzknecht (Wiener klin. Rund., Oct. 9, 1901).

GEORGE H. ROHÉ (Baltimore) and CENTRAL STAFF (Philadelphia).

ALUM.—The alum generally used is an aluminium and potassium sulphate. This salt is likewise official in the U. S. P. It occurs in the form of translucent, whitish, octahedral crystals having a sweetish and strongly-astringent taste. Alum is soluble in water, insoluble in alcohol, and soluble in heated glycerin.

Physiological Action. — Alum is an active astringent. It coagulates albumin, and when, therefore, it is applied to moist mucous membranes, it causes them to turn white. This is intensified by its power over the blood-vessels of the part, which it firmly contracts, probably by stimulating the local vasomotor nerves. It also contracts the tissues, depleting them of their blood. Upon the blood itself it acts as an effective coagulant, and is, therefore, an excellent styptic.

When administered to animals, such as dogs, cats, and rabbits, by subcutaneous injection, a soluble salt of alum causes no symptoms at all for three or four days. Then the animal experimented upon suffers from loss of appetite and obstinate constipation, emaciation, languor, and disinclination to move. Next there is vomiting and loss of sensibility, as a deep prick with a needle is scarcely felt. When forced to move, the leg is raised, but trembles and twitches violently, and is with difficulty placed on the ground. Sometimes there is general tremor or convulsive twitching and sometimes extreme weakness or partial paralysis of the posterior extremities. There is complete loss of sensibility to pain, while the animal retains its senses. Then the power of moving the tongue and of swallowing is completely lost; even the saliva cannot be swallowed. The symptoms are precisely those of human acute bulbar paralysis. (Mayer and Siem.)

Case in which, through gargling with a concentrated alum solution, a portion of the fluid was accidentally swallowed. This was followed by severe abdominal pains, vomiting of mucus and blood (thirty-nine times), and voiding of blood-stained urine. Recovery only after the lapse of thirteen days. Kramolin (Therap. Monats., 325, 1902).

Alum is credited with antiseptic power by some observers: a quality probably due to its property of coagulating albuminoid bodies. When ingested in sufficient quantities alum irritates the gastric mucous membrane and causes vomiting.

Therapeutics.—Alum may be said to be useful as an astringent in all catarrhal conditions of the mucous membranes—those of the upper air-passages, the vagina, and the urethra particularly—in aqueous solutions of from 5 to 20 grains to the ounce. Strong solutions are rarely indicated, their secondary effects being those of undue stimulation, namely: irritation.

Laryngology. — In diseases of the nose and throat the best effects are obtained from a 15-grain-to-the-ounce solution frequently applied. In acute coryza the following snuff is effective if used early:—

℞ Alum, 3 grains.
Morphine sulphate, 2 grains.
Cocaine hydrochlorate, 1 grain.
Camphor,
Bismuth, of each, 2 drachms.

To be thoroughly mixed.

Sig.: To be used as snuff every two hours, a small quantity being used in each nostril.

The glycerite of alum (a 10- to 20-per-cent. solution of alum in glycerin—heat is necessary to produce such a solution of the salt) is very effective in subacute inflammatory disorders of the pharynx and larynx, especially if there is a tendency to œdematous infiltration.

As a styptic alum is a valuable agent. It is found almost everywhere and is easily dissolved with the fluid always at hand, water.

Typhoid Fever. — As an astringent for the intestinal hæmorrhage sometimes occurring in the course of this disease it has been recommended by many clinicians, Whitla especially. It is also thought to act as an antiseptic.

Epistaxis.—In epistaxis alum sometimes acts rapidly, a saturated solution being used. Pledgets of cotton dipped in this solution are packed in the bleeding cavity and left in until all danger of recurrence has passed: generally about twelve hours. The solution may be sprayed in in slight hæmorrhages or powdered alum may be taken as snuff.

Metrorrhagia.—In uterine hæmorrhages of all kinds alum is an excellent styptic. R. Beverly Cole has recommended the insertion into the uterine cavity of an egg-shaped piece of alum. The styptic effect is not only produced, but the tissues and the organ itself are stimulated and caused to firmly contract.

Croup.—As an emetic, alum is very frequently employed in children. A teaspoonful may be dissolved in six tablespoonfuls of syrup and water, equal parts, and a teaspoonful administered every fifteen minutes until the desired effect is produced. This sometimes serves to quickly arrest an impending attack of croup, the astringent effect of the salt upon the mucosa of the throat counteracting the local hyperæmia.

ALUMINIUM. — Numerous preparations have been obtained from this metal: a boroformate, a borotartrate, a hydrate, a borotannate, and a sulphate. The double salts of aluminium are recommended as powerful antiseptics, superior to carbolic acid and sublimate in being strongly disinfecting, though but slightly poisonous. The best of them is the acetotartrate, prepared by mixing a 5 to 100 solution of basic acetate of aluminium with a 2 to 100 solution of tartaric acid and evaporating to dryness. It crystallizes in shining needles, which smell slightly of acetic acid and are freely soluble in water, but insoluble in alcohol. (Athenstadt.)

Boroformate. — The boroformate is a valuable preparation which combines astringent and antiseptic properties, al-

though the latter cannot be considered as being marked. It occurs in the form of pearly scales crystallized from a solution prepared by saturating, with freshly precipitated and well-washed aluminium, a solution of 2 parts of formic acid and 1 part of boric in 6 or 7 parts of water. It is an hygroscopic salt, dissolving completely, though slowly, in water. The solution has an astringent, sweet taste, and does not coagulate solutions of albumin.

Boroformate of aluminium has been used in the Prince of Oldenberg's Children's Hospital at St. Petersburg, where it has supplanted all other preparations of aluminium. Martenson (Pharmaceutische Centralhalle für Deutschland, No. 41, '94).

Borotartrate. — The borotartrate, or "boral," is a combination of aluminium, boric acid, and tartaric acid, and forms white crystals, non-irritant, antiseptic, freely soluble in water, and valuable in diseases of the nose and naso-pharynx; it is useful in erysipelas, and, in solution with tartaric acid, has given good results in gonorrhœa.

Borotannate. — The borotannate, or "cutol," is a combination of aluminium, boric acid, and tannic acid, and is a brownish, insoluble powder. It combines with tartaric acid to form soluble cutol. Cutol may be prescribed for ointment and is of great service in the treatment of weeping eczema and pruriginous affections in the following formula:—

℞ Cutol, 1 drachm.
Olive-oil, 2 1/2 drachms.
Lanolin, q. s. to make 10 drachms.

When the secretion has disappeared the following powder may be used:—

℞ Cutol,
Oxide of zinc,
Talc, of each, 2 1/2 drachms.

Soluble cutol gives good results in the treatment of burns of the second degree, and a solution of soluble cutol and glycerin, 1 to 10, applied locally, causes rapid retrogression of follicular angina. The same solution may be employed in catarrhal metritis. Cutol may also be employed in the treatment of hæmorrhoids.

For hæmorrhoids an ointment containing 10 per cent. of cutol may be applied, while fissures of the hands may be treated by applications of

℞ Cutol, 3/4 drachm.
Oil of sweet almonds,
Lanolin, of each, 3 3/4 drachms.
Orange-flower water, 2 1/2 fluidrachms.
Koppel (Ther. Monat., Nov., '95).

Hydrate.—The hydrate of aluminium is prepared by decomposing a solution of an aluminium salt by an alkali or alkaline carbonate. It is a light, white powder, soluble in acids and fixed alkalies. This is also a light astringent, employed in skin affections.

Sulphate. — The sulphate of aluminium, prepared by dissolving aluminium hydrate in sulphuric acid, is soluble in water, but insoluble in alcohol. Injected in the blood it induces powerful contraction in the capillaries, especially those of the lung. It is used in strong solution as an antiseptic in diseases of the nose, throat, uterus, and vagina, and as a lotion for foul ulcers, vaginal discharges, etc.

ALUMNOL is an aluminium salt of the naphthol-sulphur acids. It is a fine, white, non-hygroscopic powder, easily soluble in cold water, slightly so in alcohol, and insoluble in ether. Its unirritating quality in weak solutions makes it available for the treatment of cavity wounds and chronic catarrhal processes. In acute cases, however, it is usually irritating.

Mode of Employment. — It is not in-

compatible with sublimate, resorcin, etc., and may be combined with them in order to strengthen their reciprocal action, if it is desired to combine the action of several antiseptics.

Therapeutics. — A general review of the literature does not warrant a final opinion as to its merits, but the published reports, a few of which are given below, do not indicate that it is worthy of much confidence in the treatment of the genito-urinary tract: its main stronghold. It has been tried in gynæcological, dermatological, surgical, and laryngological cases as an astringent, and when used in weak solutions seems to have given more encouraging results.

GYNÆCOLOGY.—In $^1/_2$ to 1-per-cent. solution it has been found useful in endometritis of gonorrhœal origin, and in colpitis, if non-gonorrhœal in character. (Heinze and Liebreich.)

> Used in sixteen gynæcological cases: catarrh of the neck and endometritis with or without inflammation of the annexa. Cervical catarrh and simple perimetritis yielded to its repeated use. In endometritis complicated with lesions of the annexa the pains were augmented on account of the irritation produced. Gonorrhœal vaginitis was readily cured. The following preparations were used: A solution of 3 per cent. for lavages; a powder and bougies of 20 per cent.; and a 10-per-cent. solution as an astringent in the treatment of endometritis and of erosions. A. Kontz (Wiener med. Presse, No. 18, '93).

> Tried in 12 cases of acute gonorrhœa, 20 chronic cases (in 8 of which gonococci were present), 4 cases of gonorrhœal epididymitis, 2 of post-gonorrhœal adenitis, and 2 of soft chancre. In the first cases mentioned, treatment was begun by intra-urethral injections of a 1- to 2-per-cent. solution of alumnol three times daily. Later the same solution was used once daily, or else a feebler solution (from 0.25 to 1.00 per cent.) several times during the twenty-four hours. In 8 cases treatment was begun from one to three days after the appearance of the secretion, and from three to ten days in the other 4 cases. The drug was not found superior to any other drug generally used. Found inferior to nitrate of silver. Cases of soft chancre were the ones cured. Casper (Berliner klin. Woch., No. 13, '94).

> That alumnol does not possess the antigonorrhœal merits granted it by Chotzen shown by a trial in twelve cases. E. Samter (Berliner klin. Woch., No. 13, '94).

> Marfan uses bougies of alumnol, 3 per cent., in the treatment of vulvo-vaginitis. M. Storer (Boston Med. and Surg. Jour., Jan. 20, '98).

SURGICAL DRESSING.—In the dressing of wounds and in ulcerations of specific or non-specific character it produces, according to Eraud, no irritation or pain. This author considers it as efficacious as other powders for the desiccation of wounds. It appeared to be useful in certain varieties of pruritus, especially that of the anus and scrotum.

LARYNGOLOGY. — Alumnol has been found valuable in simple chronic and hypertrophic rhinitis, ozæna, catarrhal and follicular tonsillitis, and acute and chronic catarrhal and follicular pharyngitis, in a 1-per-cent. solution as a douche; in a watery, glycerin solution (1 to 5) for application to the affected parts; or in a powder mixed with starch (10 to 20 per cent.) for insufflation.

> In acute laryngeal affections the roughness of voice generally disappeared after a single inhalation of a 1-per-cent. solution. In chronic cases good results were obtained by the use of insufflations of a mixture of alumnol and starch (2 to 10 per cent.). A 1-per-cent. solution was of signal service as an hæmostatic in cases of hæmoptysis. A. Stepanicz (Annual, '95).

> Two years' experience showing that alumnol is of the greatest value as an astringent, especially in conditions accompanied by œdema, whatever be the

direct cause of the latter. Metzerott (Amer. Therapist, Sept., '97).

DERMATOLOGY. — It has been found useful in powder, 12 to 25 per cent.; collodion, 5- to 10-per-cent. strength; and ointment, 1, 5, and 12 $^1/_2$ per cent., in dermatitis, in acute eczemas of all sorts, in chronic eczemas; in syphilis and the parasitic skin affections it was not of much benefit. In acne and rosacea as good results have been obtained by it as by most methods of treatment. (Gottheil.)

Found efficacious in acute superficial inflammatory affections of the skin, as well as in chronic processes in which the inflammation was deeper; in parasitic diseases, such as erysipelas, favus, lupus, soft chancre, and erosions; and in acute and chronic inflammations of the mucous membrane. Chotzen (Berliner klin. Woch., No. 48, '92).

AMENORRHŒA. — (Lat.). From ἀ, priv.; μήν, a mouth; and ῥεῖν, to flow.

Definition.—Absence of the menstrual flow in women of a suitable age who are not pregnant. Suppression of menses, the menstruation having ceased through some local or remote disorder, is also termed amenorrhœa.

Varieties.—Amenorrhœa may be *complete*, when the menstruations have completely ceased; *comparative*, when it appears occasionally; *primary*, when the menstruation has not presented itself at the age of puberty nor subsequently; *secondary*, transitory or accidental, or when, having already appeared, the menstruation ceases.

Symptoms.—No other symptom than absence of the menstruation may be present, or the monthly flow may be absent and the general attendant phenomena usually preceding menstruation occur. Frequently the patient complains of headache, heat-flashes, fever, nausea and vomiting, and heaviness in the abdomen. Concomitant nervous disorders may form the basis of acute manifestations, hysterical especially. When the retention is due to uterine stricture, there is considerable pain radiating from the uterus to the surrounding parts, including the lumbar region.

Pure suppression of the menstruation usually gives rise to no symptoms, especially when the impending general disorder is the cause of the amenorrhœa. When, however, it is due to a local disturbance, the symptoms of a congestive disorder of the genital tract appear, soon followed by an inflammatory process, which may be general or local. Peritonitis sometimes appears as a result of such a process. Remote symptoms may also present themselves, doubtless of reflex origin.

Amenorrhœa virginalis a new disease, in no way connected with cessation of menstruation from chlorosis, anæmia, etc., which occurs in young women. The first symptom is the amenorrhœa, which may or may not be associated with vicarious menstruation. After awhile cardiac symptoms supervene, especially palpitation, dyspnœa, and cyanosis; the right heart fails, and œdema and death result. Two such fatal cases. The suppression of the menses led to general plethora, cardiac hypertrophy, valvular incompetence, and finally pulmonary congestion. Edelheit (Wiener med. Presse, Aug. 16, 23, '97).

Series of cases which present certain well-defined clinical features. These prominent characteristics are: (1) diminished or arrested menstruation; (2) local symmetrical imperfect oxygenation of the blood of the extremities, especially the arms and hands—a condition known as "Raynaud's phenomena"; and (3) pulmonary tuberculosis. The presence of any single one of these symptoms in patients is observed every day, but attention has not hitherto been called to the remarkable association of all of these clinical features in the same individual.

This trilogy of symptoms did not always appear contemporaneously in any of the patients who are affected. In all of them when first seen the local asphyxia and the irregularity of menstruation were marked; in two of the patients pulmonary tuberculosis was also coexistent with the other clinical features mentioned, while in two other patients it developed at a subsequent period. J. W. Byers (Lancet, Aug. 26, '99).

Etiology.—In cases of primary menstruation imperfect or insufficient development is the most usual cause. In cold countries, where growth of the system at large is more gradual, the menstruation appears later than in the warmer countries, where development is rapid, but where, also, women enter the stages of decrepitude earlier. Anatomical imperfections and anomalies, the absence of any of the genital organs, or a rudimentary or infantile uterus may thus account for the total absence of menstruation. Imperforate hymen is a frequent, though easily recognized, cause.

On general principles, the causes of amenorrhœa may be divided into four classes:—

Nervous Disorders.—Grief, anxiety, fright, and anger are as many possible primary causes, especially if the patients are poorly fed. Women who either greatly fear or greatly desire to become pregnant; newly-married women, and women who are confined in prisons or insane-asylums furnish a large proportion of the cases. Removal from country to city or *vice versâ*, especially when coupled with nostalgia, is a prolific cause. On general principles, change in the mode of living or of climate, especially with an intervening sea-voyage, appears to frequently act as the etiological factor.

Probably not less than 33 per cent. of women emigrants under 30 years of age suffer from suppressed menstruation after a sea-voyage. Many have abdominal distension, and not infrequently girls have been innocently charged with being pregnant. Obstinate constipation a common symptom. The true etiology is largely psychical and neurotic. H. C. Bloom (Univ. Med. Mag., Dec., '96).

In those cases where the follicular stroma of the ovary has been the seat of an inflammatory process during the infectious fevers, the patient may have an amenorrhœa which may remain and become permanent. Alexander Simpson (Practitioner, Aug., '98).

Case of a young married woman who found that, as soon as she left London and went to the country, her menstruation would return at the regular times, but would not if she remained in town. By leaving town for two days each month it was possible for her to regulate the monthly function. W. J. H. Hepworth (Lancet, Nov. 10, 1900).

General Affections.—Amenorrhœa frequently occurs after a serious illness, such as typhoid fever, eruptive fevers, mumps, pneumonia, or during the course of any chronic disease, diabetes, cancer, malaria, at the onset of severe syphilis, or when any intoxication of the system occurs, as in morphinism, alcoholism, and hydrargyrism.

Eighteen cases in which the morphine habit caused amenorrhœa. It is usually complete and accompanied by loss of sexual desire, but the functions are reestablished if the habit be broken. Lutaud (Revue Gén. de Clin. et de Thér., May 2, '89).

It may be consequent upon an acute or chronic surgical affection, a blow, or injury. Luxurious living and want of exercise, obesity, and excessive intellectual labor at the period of puberty, when not counterbalanced by fresh air and active exercise, may retard the development of the generative organs and thus induce the disorder.

Case of a young woman who presented many of the usual signs of pregnancy, including cessation of the menses, promi-

nence of the abdomen, etc. On examination deposits of adipose tissue were found in the abdominal walls, while the uterus was small—smaller, indeed, than usual. Subsequent events proved it to be a case in which obesity had led to disturbance, if not, indeed, early appearance, of the menstrual function. Robert A. Reid (Mass. Med. Jour., Aug., '98).

Blood Disorders and Wasting Diseases. — Anæmia and idiopathic chlorosis, pernicious anæmia, leukæmia, and Hodgkin's disease are the most prominent factors. The following causes of waste—and directly, therefore, of amenorrhœa—are also to be remembered: Hæmorrhage, albuminous discharges; hæmorrhage from piles, scurvy, purpura, and injury, as in hæmophilia; hæmorrhage from the stomach, as in gastric ulcer; from the lungs, or from the nose, and from a rare disease produced by a parasite in the duodenum: the anchylostoma duodenale. Long-continued suppuration, albuminuria, chronic diarrhœa, malignant ulcers, tubercular disease, all impoverish the blood, and so may cause anæmia. All diseases that cause wasting of the body finally cause the menstruation to cease. Chief among these are phthisis, diabetes, caries of bone, protracted or febrile illness; anorexia nervosa, the patient wasting because she will not eat; and gastric ulcer.

Lesion of Genito-Urinary Organs. —Any lesion of the genital apparatus may cause amenorrhœa, especially metritis, endometritis, and parametritis (both acute and chronic), and flexion or malposition of the uterus. Adhesion due to a previous pelvic peritonitis is an occasional cause of hyperinvolution of the uterus following pregnancy. Atrophy of the ovaries, senile atrophy following pregnancy, and cystic ovarian degeneration are among the less common etiological factors. A most complete examination of the pelvic organs should be made, if necessary, under ether in such cases.

If menstruation does not appear at the age of puberty, a careful scrutiny on the part of the physician is obligatory and imperative. Case of a young woman, 24 years of age, in whom the amenorrhœa was of organic origin. A dermoid and a suppurating multilocular cyst were found and removed. Report of the pathologist harmonizes with the theory of the case both from physiological and pathological stand-points: 1. That the dermoid had usurped the place and destroyed the function of the right ovary. 2. In one of the cyst-walls of the multilocular ovarian cyst was found a shrunken ovary the size of a large lima-bean, and within this ovarian stroma was found a corpus luteum spurium. To the presence of this ovarian stroma was due the womanly development, with ovulation and the futile effort of menstruation and its consequent suffering. 3. The case demonstrates the possibility of ovulation without menstruation. 4. It leaves doubt whether the absence of the oviducts was primary or secondary to the grave disease of the ovaries, with the possibility that they were congenitally absent. 5. It presents the rare and exceptional condition of a perfectly developed woman who had an ovary and a uterus, who ovulated, was sterile, and never menstruated, and yet was ruined in health by Nature's effort to establish an impossible normal function. W. B. Chase (Amer. Jour. of Obstet. and Dis. Women and Children, Oct., '98).

Exposure to cold during menstruation, by inducing congestion of the pelvic organs, is one of the most active exciting causes, especially when supplemented by a local chronic disorder.

The most important condition with which this disorder might be confounded is pregnancy. The reader is referred to the article under that head.

Case of a healthy girl, aged 15, who had been subject for a year to gradual swelling of the abdomen. The period

had ceased for two months only. The breasts became hard and tense. The hymen was intact. Peritonitis of tuberculous origin suspected. On opening the abdomen an enormous cyst, which contained twenty pints of fluid, discovered. Its pedicle was twisted and had risen in the parovarium. On the day after the operation the catamenia reappeared and the abdomen soon resumed its normal form. Cortiquera (Anales de Obst., Gine., y Ped., Jan., '96).

Pathology. — A pathological identity can hardly be attributed to amenorrhœa, owing to its complex causes, the diverse physiological conditions peculiar to the cases, and the diathetic conditions that may be present. The fact that the true nature of menstruation itself is not known adds another objection; and it may safely be said that the pathology of amenorrhœa is that of the diseases causing it, until the local disorders brought about by each will have been determined. The following extracts are given to indicate the present trend of thought regarding the cause of menstruation.

Blood-pressure varies greatest at the commencement of menstruation, least immediately after; remains about the same height seventeen days, when it again begins to rise. Derangement of this cycle leads to various pathological phenomena. A. W. Johnstone (Amer. Jour. of Obstet., May, '95).

Evidence recently furnished by Heape justifying opinion that ovulation is not the cause of menstruation. We should not speak of menstruation as occurring once a month, but as occupying a whole month. Lawson Tait (Provincial Med. Jour., Jan. 1, '95).

All evidence favors the theory that ovulation and menstruation are independent; ovulation in a modified form continues during pregnancy. Byron Robinson (Amer. Gyn. and Obst. Jour., Aug., '95).

Study of over three thousand cases showing that earlier menstruation in tropical countries is not due to climate, but to too early sexual excitement. Joubert (Indian Med. Gazette, Apr., '95).

Diagnosis. — Primary amenorrhœa — that is, total absence of menstruation — is usually due, as already stated, to the absence of one or more of the organs of generation. It must be distinguished from retention of the menses, due to atresia of the cervical canal, of the vagina, or of the vulva. In the latter case no menstruation has existed, but the general premonitory symptoms of menstruation have occurred, though followed by no menstrual flow. Cases in which one or more of the organs are absent are not very infrequent, while cases of imperforate hymen are comparatively common.

Prognosis. — Amenorrhœa due to absence of any of the organs is, of course, incurable. The same may be said of cases in which the approach of menopause or other conditions pointing to senility of the uterus. Although amenorrhœa, when due to a serious chronic disease, is usually cured with difficulty, hope may always be entertained when the causative disorder is not in itself a fatal one. Return of the menstruation in any chronic disorder, when the blood presents its normal appearance, is an encouraging sign.

[The prognosis of secondary atrophy with amenorrhœa depends greatly on the condition of the ovaries, and is practically hopeless if they are atrophied. MUNDE, Assoc. Ed., Annual, '90.]

Treatment. — Women who object to becoming pregnant represent a large proportion of the cases of amenorrhœa met with. Special care, therefore, should be taken not to administer emmenagogues, under such circumstances, or to introduce instruments into the uterus. In *bona fide* cases, however, amenorrhœa being more of a symptom than a disease *per se*, the original cause should be dili-

gently sought after and removed, if possible.

When diagnosis between functional amenorrhœa and pregnancy is difficult, senecio may be safely prescribed before deciding, as it will probably cure the one, and certainly will do no harm to the other. Senecio will not cause abortion nor in any way influence the course of pregnancy. W. E. Fothergill (Edinburgh Med. Jour., May, '98).

Emmenagogues may be classified into two classes: medicinal and physiological.

Severe physical shock or fright sometimes causes the menstruation to return suddenly.

When the arrest of menstruation is due to exposure to cold, warm baths and vaginal injections, sinapisms to the thighs and calves of the legs, saline laxatives and manganese-binoxide pills (2 grains each), one or two after each meal, are frequently successful. This drug acts by increasing the vascularity of the pelvic organs. The permanganate of potassium, or the lactate, in 1-grain doses three or four times daily, after meals, act in the same manner.

The following treatment is highly recommended in suppression of the menses:

℞ Liquor ferri et quinia citratis, 1 ounce.
Liquor potassii arsenitis, 3 drachms.
Strychnine,
Atropine, of each, 1/2 grain.
Elixir of orange-peel, enough to make 8 ounces.

M. Sig.: Teaspoonful in water, before meals, three times daily. The ingredients, or dose, to be increased according to the tolerance of the patient.

This is continued until there is manifested the peculiar menstrual discomfort, when it is discontinued and the following given:—

℞ Potassii permanganatis, 10 grains.

Divide into pills No. x, compressed or in capsule.

Sig.: One pill followed by one-half-glassful of water, before meals, three times daily.

Also:—

℞ Manganesium binoxide, 10 grains.

Divide into 10 compressed pills or into as many capsules.

Sig.: One pill after each meal, three times daily.

By the second or, at most, the third day after taking these the flow usually becomes fully established. If the manganese does not fully effect this at the first attempt, the first prescription is relied on during the interval, and the pills commenced about three days before the expected time.

In ordinary menstrual suppression the last two formulæ, used as above, are especially effective. De Wees (Med. and Surg. Reporter, June 30, '88).

In amenorrhœa, associated with mental diseases, the potassium permanganate is to be given in 1-grain pills three times daily, and after three months in 2-grain doses. The pills should be given fully three months after the courses appear, and must be taken without intermission. Macdonald (London Practitioner, June, '88).

Of the manganese compounds the binoxide seems to give the best general results, though it cannot always be relied upon. The lactate is also an efficient and irritating agent. Segur (Med. Record, Feb. 2, '89).

When manganese-binoxide pills are given they should be followed by a little water fifteen minutes later, in order to avoid the burning pain in the stomach, which they are liable to cause. E. J. Hauck (Va. Med. Monthly, Aug. 30, '91).

When there is any faulty constitutional condition, this should be treated. Anæmia especially requires iron with arsenic and strychnine or nux vomica, and, as the anæmia improves, menstruation is more likely to be established. As to the action of reputed emmenagogues, such as manganese dioxide, potassium permanganate, senecin, etc., the results in personal experience have not been encouraging. After a reasonable trial of drugs, if no result is obtained, it is usually ad-

visable to examine the pelvic organs, preferably under an anæsthetic, for, if a condition of under-development be present, prolonged drug treatment is futile, and is disappointing to the patient. Under these circumstances it is best to explain the condition and leave matters alone. Stimulation by electricity is usually undesirable and unnecessary in the case of single patients, though it may be tried in exceptional cases if the fact of amenorrhœa is a source of worry to the patient. The most effective stimulus is that supplied by marriage. A. E. Giles (Clinical Jour., Jan. 30, 1901).

In the amenorrhœa following sea-voyages the preparations of manganese and oxalic acid hold the first place.

In amenorrhœa following a sea-voyage a valuable combination is peptonate of iron with manganese. Oxalic acid combined with the iron and manganese in the following formula especially valuable:—

℞ Oxalic acid, 4 grains.
Peptonate of iron, 46 grains.
Peptonate of manganese, 160 grains.
Elixir of Curaçoa, 2 ounces.
Water, 6 ounces.

M. Sig.: A tablespoonful in a glass of milk three times a day.

This simple plan, with a well-regulated diet of eggs, fish, meats, oysters, milk, and vegetables that are rich in organic iron may be all that is required. H. C. Bloom (Univ. Med. Mag., Dec., '96).

When the manganese preparations fail, santonin, 10-grain doses at bed-time, is especially valuable in chlorotic subjects.

[Santonin, given in 10-grain doses at night, is a most reliable emmenagogue, particularly in chlorotic patients. Experience based upon a large number of cases. RINGER, Corr. Ed., Annual, '89.]

[We have seen it used with good effect. MUNDE and WELLS, Assoc. Eds., Annual, '89.]

The preparations of manganese and santonin may be given simultaneously: 1 grain of santonin at night and potassium permanganate in 1- to 2-grain doses thrice daily. Panecki (Amer. Jour. of the Med. Sciences, July, '94).

Senecio jacobæa is useful in functional amenorrhœa, as it not only anticipates the period, but increases the quantity. In many cases it relieves the accompanying pain and not infrequently the headaches from which some women suffer at such periods. The action of senecio jacobæa resembles that of potassium permanganate and is especially valuable in functional amenorrhœa. It causes the regularity and the copiousness of the flow. William Murrell (Brit. Med. Jour., Mar. 31, '94).

In stout chlorotics the amenorrhœa should be combated by tincture of senecio vulgaris, in 1- to 2-drachm doses three times daily. This drug tends to reduce the local pain and the headache. R. J. E. Young (Edinburgh Med. Jour., Sept., '94).

Six cases. Blood-count in one case showed: red cells, 3,000,000; hæmoglobin, 52 per cent. Placed on ferratin, 8 grains four times daily, with aloetic purges, combined with perfect rest, and rose to: red cells, 4,600,000; hæmoglobin, 92 per cent.

The following combination is recommended:—

℞ Ferratin, 3 drachms.
Ext. of aloes, 14 grains.
Ext. rhei comp., 9 grains.

M. Sig.: Make into 30 tablets; take 1 or 2 tablets twice daily. C. E. Williams (Amer. Therapist, Aug., '97).

In amenorrhœa, following combination gives good results:—

℞ Myrrh,
Aloes,
Reduced iron, of each, 75 grains.
Extract of valerian, a sufficiency.

M. Divide into 120 pills, to be kept in powdered cinnamon. Dose, five pills three times a day. Oesterlen (Centralb. f. die gesammte Ther., Feb., '98).

The general system should be invigorated by attention to diet, sleep, and clothing. Out-of-door, light exercise and sunlight are most important. This is especially the case when there is rapidly increasing obesity. In the latter

case the diet should be regulated, saline laxatives administered, or a cure at Marienbad recommended. Stimulation of the ovaries and uterus by the faradic current is especially efficient in these cases.

Cupping or scarifying the cervix is sometimes successful. These means increase the pelvic congestion and tend to counteract uterine or ovarian torpidity.

Rudimentary organs or atrophy of the uterus, if not too great, should be treated by dilatation of the uterus with tents and stimulated by the faradic current. Exercise and nourishing food should also be given. Sea-bathing is of assistance in such cases.

The rheumatic diathesis occasionally plays a part as an etiological factor. In such cases the ammoniated tincture of guaiac, 1 drachm in milk three times a day, or the tincture of colchicum-root, 10 drops every three hours until the bowels become free, will sometimes restore arrested menstruation. The salicylate of sodium is also valuable in this connection. Apiol, 4 grains daily in 1-grain pills, for fifteen days, has given good results.

Apiolin is best combined with iron. Iron should be given uninterruptedly until a few days before the expected appearance of the menses. Then, continuing the iron, apiolin should be prescribed in 5-minim doses three times daily until the appearance of the menstrual flow. W. A. Newman Dorland (Amer. Therapist, July, '92).

Eumencl, an extract made from the root of a plant called tang-kui, a Chinese remedy which contains nothing poisonous or capable of producing abortion, tried in 14 cases. In two of these there was no appreciable result. In all the others, although the medication was combined with hydrotherapy, massage, and the administration of iron. The good effect of the drug appreciable. Acting as a general tonic, it brought on the flow at the correct period, besides increasing it and making less severe the premenstrual pain. The refined extract as prepared by Merck is called eumenol. Hirth (Münch. med. Woch., June 6, '99).

Electricity is of great value, faradism, static electricity, galvanism, and galvanic intra-uterine pessaries being applicable according to the nature of the case.

Besides general treatment, percutaneous electrical application, viz.: spinal and combined spinal and abdominal applications of the galvanic current. In the former the anode is applied immovably over the lumbar region, while stabile application of the cathode is made over cervical and dorsal regions for the space of one minute, the dose being 10 to 15 milliampères; in the latter the anode is applied as before, and the cathode over each ovarian region, for fifteen to thirty minutes.

In case of retarded development the faradic current is used, the anode over the back and hypogastric region; the cathode, a well-insulated sound, is introduced into the uterus. The duration of the sitting is five to ten minutes, dose 5 to 25 milliampères. In some cases Apostoli's bipolar electrode is best used when an electrolytic action on the mucous membrane is sought for. In the majority of cases the ovaries must be included in the treatment by a cup-shaped electrode to cervix (cathode) while the anode is placed over each ovarian region; the dose is 10 to 60 milliampères for three minutes every third day. H. N. Hinton (Occidental Med. Times, '90).

Series of cases treated by negative intra-uterine electrization, with currents of 30 to 40 milliampères, for five minutes, the applications to be made about the time the menses are expected. These applications act by a complex action upon the uterus and ovaries, causing great congestion, and upon the nervous plexus presiding over the ovarian functions.

It should be reserved for cases in which amenorrhœa is only transitory, depending either upon some fault of vitality in the ovary (obesity, premature

menopause, retarded menstruation in young girls near the age of puberty) or upon a lesion of the ovaries (chronic sclerocystic ovaritis) or of the uterus (chronic interstitial metritis, destruction of the mucous membrane by chloride of zinc; or by curetting, with or without Schröder's operation).

It is contra-indicated in cases of physiological amenorrhœa dependent on pregnancy, the menopause, or lactation.

It is useless in cases following a severe disease of which it is but a symptom or sequel (chloranæmia, morphinomania, tuberculosis).

It constitutes the most efficacious treatment known for amenorrhœa not dependent upon an organic irremediable cause. Nitot (Jour. de Méd., June 26, '92).

[We can only approve, in confirming it, of the author's conclusions. In rebellious cases the action of galvanic currents may sometimes be powerfully aided and completed by sinusoidal currents, which favor the flow of blood, either during the menstrual period or outside of it. APOSTOLI and GRAND, Assoc. Eds., Annual, '93.]

Extract of cows' ovaries has been used with success, but further trials with this agent are required to establish its actual value.

Experiments with three fresh cow-ovary preparation (Merck's); the entire ovary, the canals, and a precipitate of the contents of the follicle-contents. The remedies were administered in form of tablet containing 4 grains each of the ovary preparation and common salt. The results obtained in eleven cases do not warrant any positive conclusion, although encouraging as to future trials. R. Mond (Münchener med. Woch., xliii, No. 14, '96).

Ovarian treatment, administered under the form of dried powder of the ovaries of heifers, in the dose of 4 or 5 grains daily, is not dangerous. In order to act it should be continued for some months; it is indicated in amenorrhœa, chloranæmia, artificial menopause due to removal of the genital organs, and accidents of the normal menopause. L. Touvenaint (Revue des Sci. Méd. en France et à l'Etranger, Jan. 15, '96).

Extract of ovaries found especially valuable in amenorrhœa attending chlorosis among a large number of cases in which it was tried. Muret (Revue Méd. de la Suisse Rom., July, '97).

E. E. MONTGOMERY,
Philadelphia.

AMMONIA.—Ammonia is a transparent, colorless gas very acrid to the taste and giving a markedly alkaline reaction. It is made, in large quantities, from coal-gas, by heating the ammoniacal liquor with calcium hydrate, then conducting the gas through tubes containing charcoal. It may also be obtained by heating a mixture of dry slaked lime with chloride of ammonium. It evaporates with exceeding rapidity. It is very soluble in water.

Dose and Preparations.—The preparation used in medicine is a strong solution, or water of ammonia, the aqua ammoniæ fortior, U. S. P., which contains 28 per cent., by weight, of gas; it is used mainly as a vesicant. A weaker solution (hartshorn), the aqua ammoniæ, U. S. P., is more generally employed, and contains 10 per cent. of the gas by weight.

Liniment of ammonia: composed of water of ammonia, 30 parts; cottonseed-oil, 70 parts.

Camphorated liniment of ammonia: composed of water of ammonia, 30 parts; camphor-liniment, 70 parts.

Aromatic spirit of ammonia: composed of carbonate of ammonia, 40 parts; water of ammonia, 100 parts; oil of lemon, 12 parts; oil of lavender-flowers, 1 part; alcohol, 700 parts; water enough to make 1000 parts. Dose, 30 to 60 minims.

Spirit of ammonia: an alcoholic, colorless solution containing 10 per cent.,

by weight, of the gas. Dose, 10 to 30 minims.

Fœtid spirit of ammonia: composed of 1 part of asafœtida to 21 parts of spirit of ammonia. Dose, $^1/_2$ drachm.

Ointment of ammonia: composed of 17 parts of water of ammonia, 32 parts of lard, and 2 parts of oil of sweet almonds.

Physiological Action.—Ammonia is a most powerful irritant to the tissues; if the exposure be long, local death and sloughing ensue. Inhaled it may also produce rapid death by œdema of the glottis or spasm. Moderate inhalations cause bronchitis, or at least tracheitis. Upon the nervous system it acts as a spinal excitant, increasing reflex action and spinal activity. Applied directly to a nerve, either motor or sensory, it paralyzes it; in very weak solution it seems to increase its functional activity. The circulation is increased to a great extent: the pulse-rate, pulse-force, and arterial pressure being due to stimulation of the accelerator nerves of the heart. The force of the action of the ventricles is much increased, and this, in turn, increases arterial pressure. In moderate amounts ammonia does not change the blood, but in poisonous quantities it causes it to cease absorbing oxygen. The rate of respiration is increased by stimulation of the respiratory centre; the respiratory movements become not only more full, but more rapid. Inhaled in small amounts, it causes the same action to a smaller degree. When large amounts are taken, ammonia is eliminated by the breath, is burnt up in the system, and is excreted in the urine.

Ammonia Poisoning.—True poisonous effects are rarely observed, the intense caustic action of ammonia upon the mucous membranes of the mouth and throat causing the liquid to be coughed out almost immediately in the majority of instances. Spasm of the glottis and œdema may cause death. If the liquid is swallowed the mucous layer of the œsophagus becomes acutely inflamed, softened, and ulcerated, and stricture of the œsophagus usually follows.

> Case of a woman, 56 years of age, who swallowed some stronger water of ammonia and immediately had severe pain in the neck. She drank some milk, vomited copiously, and was then taken to the hospital. She was dyspnœic; complained of burning pains in the mouth, throat, and stomach; repeatedly vomited a material that was strongly alkaline and contained some blood; but, as a result of treatment with citric acid and the application of ice externally and morphine internally, gradually improved and recovered. During the poisoning she had a profuse secretion of saliva. The symptoms were partly those of chemical injury to the tissues, partly the dyspnœa. The circulation suffered very slightly. In the case reported the central nervous system appeared to be relatively intact. The prognosis is always serious. Reckzeh (Münchener med. Wochen., March 3, 1903).

Treatment of Ammonia Poisoning.—The antidotes are vinegar and lime-juice. Bland liquids—such as oil or milk—should be given, and stimulants—such as strong coffee—should be administered by rectal injection if the patient is unable to swallow. Hypodermic injections of ether or digitalis are valuable to sustain cardiac action if there is marked depression or shock.

Therapeutics.—Asphyxia, Collapse, and Shock.—In asphyxia, whatever be its origin, ammonia is a valuable agent, taken internally and simultaneously inhaled. During the latter procedure, however, care should be taken to not spill the liquid into the mouth or nose of the patient, which is likely to occur when he is in the recumbent position. Serious in-

jury has followed accidents of this kind. In collapse and heart-failure, from 10 minims to a drachm of the water of ammonia, mixed with 6 drachms of sterilized water, may be injected into a vein.

In infants, the stage of collapse occurring in summer diarrhœa may also be counteracted with a few drops of ammonia occasionally administered.

> In extreme stupor Fischer sometimes gives 3 drops of aromatic spirit of ammonia, with 10 drops of water. (Post-graduate, Sept., '92.)

Gastric Hyperacidity.—In this condition, characterized by "heart-burn," acid eructations, and in fermentative processes following the ingestion of certain kinds of food, a few drops (3 to 5) of water of ammonia or 10 drops of the aromatic spirit in a little water frequently afford prompt relief. The fact noted by Sir Benjamin Ward Richardson that ammonia was antiseptic probably accounts, in a measure, for its effectiveness in arresting fermentative processes.

Alcoholism.—In acute alcoholic intoxication the various preparations of ammonia are considerably used. (See Alcoholism.) Lavage of the stomach, followed by 10 drops of water of ammonia in a half-tumblerful of water, promptly counteracts the effects of intoxication.

Cholera. — For the algid stage, ammonia internally and ether hypodermically, besides the free administration of alcohol, have been highly recommended by Giacich, the aim being to support the failing heart. Marked improvement in the general condition was noted within two hours after the institution of this mode of treatment, and over 50 per cent. of those who had reached the algid stage are said to have been saved. Dumontpallier also recommends for the same purpose the hydrochlorate of ammonium. Besides the return of heat and perspiration caused by this salt, it increases diuresis, and therefore increases the elimination of the toxic elements of the disease.

Stings of Insects, Snake-bites, etc. —In lesions produced by venomous reptiles and insects, and carnivorous animals the antiseptic and corrosive effects of ammonia can be utilized to great advantage. The best plan in snake-bites is to apply it directly to the wound and to inject into a vein a solution of 30 to 60 minims in 6 drachms of water. The pure ammonia-water applied over the bites or stings of insects is effective; it reduces markedly the pruritus and pain.

Rheumatism. — The liniment sometimes quickly relieves mild forms of rheumatism and lumbago. When the skin is delicate, as it is in women, it acts as an active rubefacient.

AMMONIUM.—When an acid gas and ammonia-gas are brought together without liberation of hydrogen, a compound of ammonium is formed, which varies with the acid radicle forming the basis of the combination. We thus have formed the following salts:—

Ammonium arseniate, dose, $^1/_{60}$ to $^1/_{25}$ grain.

Ammonium benzoate, dose, 10 to 30 grains.

Ammonium bicarbonate, dose, 10 to 60 grains.

Ammonium borate, dose, 10 to 20 grains.

Ammonium bromide, dose, 10 to 60 grains.

Ammonium carbonate, dose, 2 to 10 grains.

Ammonium chloride, dose, 5 to 30 grains.

Ammonium fluoride, dose, $^1/_{100}$ to $^1/_{25}$ grain.

Ammonium formate, dose, 1 to 5 grains.

Ammonium iodide, dose, 3 to 5 grains.

Ammonium nitrate (employed in the manufactures).

Ammonium nitrite, dose, 20 to 40 grains.

Ammonium phosphate, dose, 10 to 20 grains.

Ammonium picrate, dose, $^1/_2$ to 1 grain.

Ammonium salicylate, dose, 10 to 40 grains.

Ammonium sulphate (employed in the manufacture of aqua ammoniæ).

Ammonium sulphite, dose, 20 to 60 grains.

Ammonium valerianate, dose, 2 to 10 grains.

Physiological Action. — Some of the salts of ammonium stimulate the spinal cord and have no marked paralyzing influence upon the motor nerves, while others have no distinct stimulating action on the cord, and paralyze both it and the motor nerves. Many ammonium salts stimulate the vasomotor centres. These varied actions are mainly due to the acid radicle entering into the combination of the majority of ammonium salts. These, including the arseniate, the benzoate, the picrate, etc., will be treated under the headings including their acid radicle: Arsenic, Benzoic Acid, Picric Acid, etc. Others owe their properties mainly to the ammonium acting as base. The most important of these will be treated of in the following sections.

Ammonium Acetate.

The ammonium acetate is seldom used in its natural state; but it enters into the preparation of spirit of Mindererus (liquor ammonii acetatis), which, in turn, is extensively employed. This is prepared by saturating dilute acetic acid with ammonium carbonate. This forms a colorless liquid, which gives off a very faint odor of acetic acid. It has an unpleasant saline taste.

Dose. — The dose of spirit of Mindererus is 1 drachm to 2 tablespoonfuls, repeated every two or three hours.

Physiological Action. — Although the general use which this preparation enjoys indicates that it possesses some active virtues, all that can be said of it is that it is a weak stimulating diaphoretic possessing also diuretic properties. The latter it exerts without irritating the kidneys, increasing both the quantity of fluid and the excretion of solids.

In the light of our present knowledge, however, the properties just mentioned would seem to fulfill precisely the conditions desirable for the elimination of toxic products, in which process the skin and the kidneys play so prominent a part.

Therapeutics. — It is especially used at the outset of adynamic fevers and, in fact, should only be used during this period of any disease, before the stage of depression is near. Sweet spirit of nitre is generally preferred, owing to its more agreeable taste. It affords relief in some cases of dyspepsia as an antacid.

Ammonium Carbonate.

Ammonium carbonate is prepared by heating a mixture of ammonium chloride and calcium carbonate, then condensing the product. It occurs in white translucent masses, which, on exposure, become opaque and friable, owing to the fact that it parts with its ammonia and passes from a sesqui- into a bi- carbonate. It has a pungent odor, a sharp taste, and an acid reaction. It is soluble in four and a half times its weight of water.

Dose. — The dose of ammonium carbonate is from 5 to 10 grains, which

should be repeated in two hours at the longest, the effect of the drug being evanescent.

Physiological Action. — Ammonium carbonate possesses to a smaller degree the stimulating properties of ammonia. It excites the functions of the skin, the kidneys, the bronchial glands, and the epithelium. It reduces the normal gastric acidity and tends to irritate the stomach and cause vomiting if given in too large doses. It is thought to play an important rôle in the formation of urea and glycogen when penetrating the liver with a carbohydrate, the administration of food with ammonium salts being known to encourage the excretion of urea. Carbonate of ammonia also possesses antiseptic properties.

> A 5- to 8-per-cent. ammonium solution will preserve rabbit-fat ten months from decomposition. A 5-per-cent. solution of ammonium carbonate also acts as an antiseptic. Meat, animal organs, etc., kept in fumes of this drug, look nearly the same after six months. C. Gottbrecht (Archiv für exp. Path. und Pharm., B. 25, H. 5, 6, '90).

Therapeutics.—This drug is especially valuable in diseases of the respiratory tract. It acts as an active expectorant. In bronchitis, especially in the chronic form, when the dyspnœa is marked and the general adynamia is caused by interference with the functions of the pulmonary tract, it probably represents the best agent at our command. H. C. Wood regards it as the best preparation for continuous use in typhoid pneumonia. In both of the diseases mentioned it may be given in doses of from 5 to 10 grains, repeated every two hours, the effects of this dose upon the system lasting no longer than that time.

It is a valuable drug as a cardiac and nervous stimulant in the capillary bronchitis — broncho-pneumonia — of children.

In acute coryza it is also employed with satisfactory results.

> The best means of aborting an attack of acute coryza is the administration of rather large and frequently-repeated doses of carbonate of ammonia. Beverly Robinson (Boston Med. and Surg. Jour., Nov. 14, '89).

Ammonium Chloride.

Chloride of ammonium—or, as it used to be preferably called, muriate of ammonia, or "sal ammoniac"—is a white, translucent salt, having no odor, but a sharp, saline taste. It dissolves in three parts of cold and in one part of boiling water, and sublimes without decomposition at red heat.

Dose. — The usual dose is 5 to 10 grains, but when a sudden effect is to be produced, as in alcoholism, from 30 to 60 grains may be administered, with a copious draught of water.

Physiological Action.—Applied in its solid form or in saturated solution, ammonium chloride acts as an irritant upon mucous membranes. When given continuously for some time, it is thought to produce a profound impression upon the blood itself, lessening its plasticity and impairing its constitution; it may then cause prostration accompanied by the extravasation of blood under the skin, hæmaturia, and hæmorrhages from the mucous membranes. In smaller doses long continued it tends to impoverish the blood, the latter containing less than the normal percentage of solids. It increases very notably all the solids of the urine, except the uric acid. It affects the mucous membranes, encouraging nutritive changes and the exfoliation of epithelium. Its chief elimination takes place through the kidneys.

Ammonium-Chloride Poisoning.—The

experimental evidence published is contradictory, but it tends to show that this salt does not possess much toxic power even in large doses.

Gourinsky, after some experiments on frogs and pigeons poisoned with ammonium chloride, reached the following conclusions: In frogs whose spinal cord has been divided below the medulla oblongata, ammonium chloride produces from the first a marked augmentation of reflex acts. In frogs deprived of certain parts of the central nervous system (spinal cord, medulla oblongata, the cerebellum alone being retained) this augmentation is preceded by a marked depression. In normal frogs and pigeons chloride of ammonium produces at first depression of the central nervous system, then convulsions: that is, the higher centres exercise a great inhibitory influence on the spinal reflexes. When the poison is introduced rapidly the first stage (that of depression) is but slightly marked, and soon gives place to the second stage (that of irritation, ushered in by convulsions). When the poison is introduced slowly the general nervous depression is well marked and lasts a long time. In frogs and pigeons deprived of the cerebral hemispheres only, whatever be the method of introducing the poison, convulsions are not preceded by depression, but the latter is sometimes replaced by irritability. All the facts can be explained only by the reciprocal action of the nervous centres on each other, modified by the poison.

In a case in which a large quantity of ammonium hydrate had been taken the mucous membrane of the anterior part of the mouth was denuded, and the peculiar fact was noted that after three days, when solid nourishment was again taken, the food appeared to be saltless. P. Carles (Jour. de Méd. de Bordeaux, July 13, '90).

Therapeutics. — Ammonium chloride is especially valuable in all disorders in which the mucous membrane is involved.

Gastric Catarrh and Hepatic Torpor.—That ammonium chloride is valuable in catarrhal disorders of the stomach, especially in children, is sustained by the frequency with which it is still resorted to. It may be given in compressed pills, but a half-tumblerful of pure water should be taken simultaneously to prevent the irritating action of the salt itself upon the gastric mucous membrane. Milk may be used instead of water.

In all conditions characterized by torpidity of the liver, whether due to subacute hepatitis or general asthenia, chloride of ammonium is very valuable, in doses of 20 grains three times a day.

In doses of $1\frac{1}{4}$ drachms per day it enhances the assimilation of fatty articles of food, increases the diuresis, and diminishes the body-weight. W. V. Malinine (Thèse de St. Petersbourg, '93).

In daily doses of 75 grains chloride of ammonium increases the assimilation of nitrogenous food. The elimination of improperly-oxidized products of neutral sulphur and of nitrogenous waste is augmented. It diminishes the number of the stools, but increases the absolute quantity of urine and the urinary salts. The reaction of the urine remains acid, but its specific gravity is diminished. V. S. Tchernycheff (Thèse de St. Petersbourg, '93).

Ammonium chloride acts as a stimulant to the liver, causing at the same time a slight diminution in the amount of free iron in the organ. T. L. Brunton and S. Delépine (Proceedings of the Royal Soc., No. 334, '94).

Encouraging results from the use of ammonium chloride in dysentery. Sixty grains may be given every four hours; this rapidly decreases the amount of blood and the severity of the pain. J. W. S. Attygalle (Brit. Med. Jour., Jan. 29, '98).

Disorders of the Respiratory Tract.—Ammonium chloride has long been used as an effective remedy in almost every disorder of the respiratory tract. In recent years, however, the carbonate has replaced the chloride in the treatment of pulmonary disorders, but the chloride is still considerably used in chronic bronchitis.

The fumes generated by the action of hydrochloric acid upon ammonia are considerably used as inhalents and are quite effective in mild chronic disorders.

> Nascent ammonium chloride may be used to advantage in pneumonia. It may be generated by shaking together two cloths, the one wet with strong ammonia and the other with commercial hydrochloric acid. The nascent ammonium chloride is suspended like smoke in the room, and is inhaled by the patient. This substance is a germicide, the free ammonia is a tonic and stimulant to the lungs, and the acid supplies the deficiency of chloride. This method does not disturb the patient. T. Ashburton (Albany Med. Annals, No. 7, p. 360, '97).

The value of chloride-of-ammonium troches as a stimulant for pharyngeal disorders is well known. It serves the double purpose of increasing local lubrication by stimulating the acini, and of gently enhancing hepatic action. It may also be used in the form of spray.

> Ammonium chloride in the form of a spray is valuable in the various catarrhs of the respiratory tract. Krakauer (Centralb. f. klin. Med., Oct. 15, '89).

Middle-Ear Disorders. — The use of chloride-of-ammonium vapor in affections of the middle ear has been prompted by its effectiveness in the treatment of catarrhal affections of the nasal mucous membrane, with which many aural disorders are intimately connected.

> Chloride-of-ammonium vapor may be generated by attaching a Richardson continuous-spray apparatus, by the proximal end of the elastic ball to the distributing-tube of a Vereker chloride-of-ammonium inhaler, and a Eustachian catheter to the distributing-end of the spray-apparatus. A few squeezes must first be given to the ball so as to fill the apparatus with gas before introducing the catheter.
>
> Again, if such a catheter, or even a glass tube drawn to a point, be affixed to a Higginson syringe, one of the best and handiest means of syringing the external ear will be afforded. The small and practically continuous jet, applied with any force desirable, almost immediately tunnels a hole in the hardest cerumen and quickly allows of that reflex current necessary for its removal, doing away with the need for clumsy ear-syringes. J. MacMunn (Brit. Med. Jour., Oct. 19, '95).

Cystitis.—In catarrhal inflammation of the bladder chloride of ammonium sometimes proves very effective, especially if taken with a tumblerful of water. Ten grains every four hours the first day and 5 grains the second day and thereafter soon cause the local distress to at least greatly diminish.

> Ammonium chloride valuable in cystitis, primary or secondary. A capsule containing 5 grains of pulverized purified drug should be taken three of four times in twenty-four hours, preferably when the stomach is empty, and followed immediately by a half-gobletful or a gobletful of pure cold water. Faithfully tried in a large number of varied conditions with most satisfactory results. In the majority of cases the urine was rapidly cleared of mucus, blood-corpuscles, pus-corpuscles, urates, and phosphates, and the distressing symptoms speedily disappeared. Corrie (Virginia Med. Monthly, vol. xx, No. 6, '93).

Alcoholism. — In alcoholic intoxication the chloride of ammonium acts as effectively as ammonia. Its beneficial influence upon the liver renders it preferable to the latter. Thirty grains, re-

peated in thirty minutes, effectively brings the sufferer to his normal condition, as far as the mental aberration is concerned. This action will be continuous if an emetic or lavage of the stomach have previously been resorted to.

> Case of delirium tremens in which 1 grain of morphine hypodermically did not produce the slightest effect. After the symptoms had all become aggravated, 1 drachm of chloride of ammonium given. This was promptly vomited. After a short time another drachm given, which was retained. In fifteen minutes the hallucinations—snakes, etc.—disappeared, and the patient became quite rational. In forty minutes he was asleep. Gilbert G. Cottam (Medicine, Nov., '96).
>
> Case of a woman who had been intoxicated for eight days. She had "reptile" hallucinations, etc. Chloride of ammonium, ½ drachm in a large quantity of water, taken in two gulps. In fifteen minutes she was quieter; in fifteen minutes more the other half-drachm was given. In a short time she was asleep. W. B. Gossett (N. Y. Med. Jour., Jan. 23, '97).

Neuralgia and Migraine.—In these disorders ammonium chloride frequently gives considerable relief, especially if given with tincture of aconite. Twenty grains of ammonium chloride with 2 minims of the tincture used every half-hour three times usually procures considerable diminution of the suffering.

> Chloride of ammonium in supra-orbital neuralgia relieves the pain at once. It should be administered internally, and a small amount of it, finely powdered, be drawn into the nostril of the affected side. Chetan Shah Naug (Indian M d. Gaz., Apr., '88).
>
> Good results obtained from doses of 20 grains in obstinate neuralgia. Green (Med. Press and Circular, Sept. 22, '88).

Wounds.—In the treatment of wounds its antiseptic qualities have been emphasized by H. C. Wyman, who obtained good results from an antiseptic gauze steeped in an ammonium-chloride solution, 1 ounce to ½ pint of water, especially in contused wounds. The circulation of the blood is increased in the parts which have been deprived of the wholesome influence of the blood-current.

AMYL-HYDRIDE. See Pentane.

AMYLENE is a derivative of fermentation of amyl-alcohol, which in the pure state has an oily character and an odor resembling that of old whisky. It appears in the form of a liquid with a specific gravity of 0.689 at 60° F. and a boiling-point of 95° F. It is soluble in water in the proportion of 1 part to 9319 parts, and is readily soluble in alcohol and in ether. It is said that water dissolves 2.35 per cent. of amylene-vapor, the water tasting of amylene for a long time. It has antiseptic properties, like nitrite of amyl, and prevents the putrefaction of blood. The odor evolved from a bottle that has contained blood and amylene resembles that of rosemary. The drug prevents decomposition of fresh flowers, but changes their color.

Physiological Action. — Amylene was at one time considerably used as an anæsthetic. It causes a slight excitement, a rapid inebriation, followed soon afterward by weak extremities, sudden collapse and coma, with total insensibility to pain, and, though rarely, with an equivalent loss of consciousness. Experiments on human beings have shown that the vapor of amylene, by inhalation, produces a state of anæsthesia in which acts of consciousness, previously conceived and carefully carried out, may be performed, without remembering afterward any single fact connected with the action. This is a remarkable phenomenon, and seems to show that the human

brain may exhibit objective consciousness apart from the subjective consciousness of life; in other words, a consciousness of which it is itself unconscious, and this under the mere influence of a volatile fluid which mixes so indifferently with blood at 98° F. that one part of it only will combine with a little over 10,000 parts of blood. This action of amylene and the phenomena of somnambulism seem to present a certain analogy.

Untoward Effects.—In sufficiently-large doses amylene produces death, and the only post-mortem change observed is engorgement of the right heart. No change in the color of the blood is produced; neither is there any alteration in the corpuscles or in the natural period of coagulation of the blood observed. It lessens muscular power, but this effect is not lasting. The fatal action of amylene is attributed not to any inherent powers of its own, but to the fact that when the drug finds access to the circulation it separates in the form of vapor, producing bubbles, and thus acts like air introduced into a vein.

Therapeutics. — The insensibility caused by amylene is quite complete, but exceedingly transient. After the drug is removed, recovery is rapid. Before complete insensibility is produced, three well-marked stages are observed: The first is one of mild excitement, during which the face becomes red and congested; the second is a period of staggering inebriety; and the third stage one of collapse and insensibility. A peculiar muscular tremor is frequently noticed. Locally, in the form of a spray, amylene acts as an efficient anæsthetic, being more rapid than anhydrous ether and more stable than amyl-hydride, which it closely resembles in its physiological action. (Benjamin Ward Richardson.)

AMYLENE-HYDRATE. — Amylene-hydrate, a tertiary amyl-alcohol, is a volatile, colorless liquid giving off an unpleasant peppermint-like odor. It is soluble in eight parts of water and is miscible with alcohol in almost all proportions. It was introduced by von Mehring as an hypnotic, and has since held a favorable position as such.

Dose. — For adults, the dose is 30 to 45 minims by the mouth, and 40 to 75 minims by the rectum. It should be kept in well-stoppered bottles. The disagreeable taste may be avoided by administering it in capsules.

The following formula has been recommended as efficient, while agreeable to the patient as well:—

℞ Amylene-hydrate, 1 drachm.
Water, 2 ounces.
Orange-flower water, 2 ounces.
Syrup of bitter orange, 1 ounce.
—M.

Of this mixture one-half may be taken at night. Amylene-hydrate leaves no bad taste in the mouth or disagreeable odor on the breath on awaking, such as are noticed after paraldehyde. The dose need not be increased, as a rule, even after repeated use.

Morphine may sometimes prove a valuable adjunct to amylene-hydrate when an analgesic effect is also required. The following formula has been recommended by Fischer:—

℞ Amylene-hydrate, 1 $^1/_2$ drachms.
Morphine hydrochlorate, $^1/_4$ grain.
Distilled water, 3 ounces.
Extract of licorice, 2 $^1/_2$ drachms.
M. Sig.: To be taken in two doses two hours apart.

If, owing to the nature of the case, it is necessary to administer the above agents by the rectum, the following may be used:—

℞ Amylene-hydrate, 1 drachm.
Morphine hydrochlorate, 1/4 grain.
Mucilage of acacia, 5 drachms.
Water, 1 1/2 ounces.—M.

Physiological Action.—Like alcohol, it first excites and then successively paralyzes all the nerve-centres. Toxic doses paralyze the cord and medulla, finally abolish reflex activity, arrest respiration, and paralyze the heart. The fatal doses were found to be 15 to 30 minims per kilogramme weight of animal. A very marked diminution of temperature is produced, intensifying the danger of life. Muscular spasms produced by poisons, such as santonin and picrotoxin, are delayed or alleviated. It cannot be employed subcutaneously, owing to the severe pain produced. (Harnack and Meyer.)

As an active antipyretic in warm-blooded animals it has also been credited by Harnack and Meyer with considerable power. The smaller the animal, the more marked the fall in temperature, which sometimes is as much as 11° C. (19.8° F.): from 38° to 27° C. (100.4° to 80.6° F.). This lowering is due to the direct action of the drug upon the thermic centres; at all events, the dilatation of the vessels is less pronounced than after the administration of chloral-hydrate. In man, however, amylene-hydrate does not influence the temperature to any degree, even in fever, and clinical observations are necessary to prove its value. It acts but feebly upon the respiration, heart, and vessels of warm-blooded animals; in man the sphygmograph shows some modifications in the pulse-curve. Experiments made upon the isolated frog's heart and the muscles in general show it to be a muscular poison; the muscles, at first excited, become paralyzed. It is regarded as an excellent antidote to all convulsants, especially when the convulsions are of cerebral origin (as in poisoning by santonin). Given internally, it diminished the elimination of urea; but, administered subcutaneously, it augmented its elimination. This latter phenomenon is due to its local irritating action (phlegmonous inflammation, abscess, or necrosis of the tissues).

The property possessed by amylene-hydrate of modifying secretions has been generally lost sight of, according to Brackmann, Scharschmidt alone having noted that some patients perspire at the beginning of its use. In the single instance in which it was used, a case of diabetes, an evening dose of 50 grains diminished the thirst, lessened the quantity from 230 to 100 ounces, and raised the specific gravity from 1005 to 1011 in six days. On the omission of the remedy the symptoms returned.

Amylene-hydrate Poisoning. — Untoward effects were noted by Dietz. In four instances a large overdose was given through neglect to shake the bottle in which the drug was mixed with syrup; deep sleep followed, from which the patients could not be aroused. There was total paralysis and suppression of tactile sensibility, including that of pain, and of corneal reflex. The pupils were dilated, and reacted but slowly to light. Respiration was retarded, superficial, and irregular; the pulse small, soft, and slow; the temperature lowered in two cases to 95° F. Artificial respiration was required in the case of one patient. During recovery there were confusion of ideas and inco-ordination of bodily movements. The author likens the toxic effect to that produced by alcohol. He advises that to avoid such accidents the drug be administered in capsules.

Therapeutics.—Amyl-hydrate is justly

considered by the majority of observers as an excellent hypnotic. It may be administered during long periods, owing to a quality not possessed by chloral: *i.e.*, it does not tend to increase nitrogenous waste.

> Experiments showing that the action of amylene-hydrate is entirely opposite to that of chloral-hydrate, the latter increasing the quantity of nitrogen eliminated by the urine, the former lessening it about two grammes. That excreted by the fæces showed no change. Amylene-hydrate, therefore, prevents the destruction of albuminous substances, and it is preferable as a narcotic to chloral-hydrate whenever the hypnotic effects are to be continued for a long time, and in all affections in which there is an exaggerated decomposition of albuminoids; fever, more or less intense; very pronounced dyspnœa; anæmia and hectic diseases, especially pulmonary phthisis and diabetes; and also cases of digestive troubles with concomitant anorexia. J. Peiser (Fortschritte der Med., No. 1, '93).

It is especially in the insomnia of mental disorders that it has been employed. Headache sometimes follows its use.

It acts especially well in insomnia resulting from nervousness, excessive mental exertion, anæmia, fevers, cardiac diseases, insanity, and after the withdrawal of narcotics that have been constantly used. It is contra-indicated in insomnia from pain, cough, and frequently in cardiac and uræmic dyspnœa, and in gastric disorders attended with irritation or nausea, but in such cases its administration by the rectum is followed by the usual beneficial results. Many patients and children do not tolerate it on account of its taste and odor, but it is readily taken when administered in soft capsules. Unusual effects are produced only by large quantities, and consist in loss of reflexes, paralysis of extremities, mydriasis, low temperature, feeble pulse, and shallow respiration. No cases have been observed in which an amylene-hydrate habit was engendered, or a cachexia developed, due to the remedy. (W. H. Flint.)

To produce sleep in the above disorders it may be administered by the mouth or by enema with gum arabic and water. Unlike chloral, it has no irritative action on the mucous membrane of the rectum. Sleep comes on after fifteen to forty-five minutes, though often sooner, and occasionally no effect at all is produced. On the whole, it is a reliable hypnotic, if given in sufficient dose: two to three times as large as that of chloral, though it is somewhat less certain in its effects than is this substance or morphine. Unpleasant secondary effects, as excitement or slight drunken-like stupor, are very seldom witnessed. It does not lose its efficiency,—though given during three months in some cases,—and the deep and refreshing sleep is praised by the patient oftener than in the case of any other hypnotic. The drug is more powerful than paraldehyde or urethan, and is to be preferred to them. It should always be chosen in heart disease in place of chloral, though it is not so strong as the latter. It is fully equal to sulphonal, and, indeed, superior to it in many respects. Three capsules, each containing 15 minims, are easily taken on retiring, and will almost certainly produce sleep. The effect follows much more promptly than after sulphonal, and it has not the same tendency to produce sleepiness and giddiness on the following day. (E. Kirby and J. P. C. Griffith.)

Epilepsy. — Evidence is not lacking to show that it is valueless and even dangerous in epilepsy. Umphenbach noticed from its use increased mental

confusion and decided disturbance of sleep. Dunn experimented upon fourteen cases. He noticed from the drug at first an apparent transient improvement in some cases, though in others the number and severity of the attacks were increased from the beginning. A marked tendency to the development of *status epilepticus* manifested itself in some cases, while others sank into a state of coma, with subnormal temperature and slow, heavy respiration. The mental condition of patients under this treatment did not improve at all, even in those which appeared at first to be benefited in the number of attacks.

Insanity.—Amylene-hydrate has been thoroughly tried in cases of mental disorder. It is an hypnotic of a high order, occupying a position between paraldehyde and chloral. It is superior to the first in its less injurious action on the heart, and to the second in the absence of unpleasant odor on the breath.

In a large number of cases Lehmann obtained good results, though in mania large doses were required. Paralysis of the insane was benefited, but the insomnia of melancholy was aided to a less degree. Lehmann considers it more efficacious and less unpleasant than paraldehyde. It is quite effective in alcoholic delirium.

> In 149 observations 83 per cent. showed marked benefit, 15 to 75 minims being administered. Large doses were required in mania; the insomnia of melancholia was aided to a lesser degree than that of other disorders. It is more efficacious and less unpleasant than paraldehyde. Lehmann (Ther. Monat., Dec., '87).
>
> In 300 observations sleep came on between 15 and 45 minutes; occasionally no effect was produced. Although, as a rule, no unpleasant secondary effects were noted, 37 minims caused a condition resembling drunkenness in an hysterical woman. Avellis (Deutsche med. Woch., No. 1, '88).

Opium Habit.—Sleep, lasting through the night with but little or no intermission, was obtained by Kirby and Griffith in a case of opium habit, in which chloral, bromides, paraldehyde, and hyoscine, given singly or variously combined, had produced but indifferent results. Like results have been noted by other observers.

Pulmonary Disorders. — In pulmonary disorders, G. Mayer found amylene-hydrate a reliable and pleasant hypnotic. It appeared not only to produce sleep, but to have a decided sedative influence on the cough. In phthisis it proved itself useful in this respect, after morphia had had but little effect. When there is pain or very troublesome cough, however, it is not so uniformly successful.

AMYLIFORM.—Amyliform is a true chemical combination of formaldehyde and starch. It occurs in the form of a white powder, without odor, insoluble in all liquids, and is very stable and not easily altered. It is gritty, or feels like sand when rubbed in the hands. In the body it is decomposed slowly into formic aldehyde and starch.

Therapeutics.—Formic aldehyde being a powerful bactericide, antifermentative, and antiputrefactive, amyliform proves useful in antiseptic surgery. Employed as a powder, it was found to diminish in a rapid manner the secretions upon sores, particularly those which have a bad odor. It is strongly antiseptic, deodorant, and absorbent.

> Amyliform is absolutely free from irritating properties, and non-toxic. It favorably affects the secretion, prevents tissue-necrosis, does not form a dry crust which retains secretion, and will absolutely prevent the foul odor from gangrenous wounds. Classen (Therap. Monat., Jan., '97).

AMYL-NITRITE. See NITRITES.

AMYLOID LIVER. See LIVER, DISEASES OF.

AMYL-VALERIANATE.—Amyl-valerianate, introduced by Blanc, represents the odoriferous principle of the apple: that is, the essence extracted by distillation together with alcohol.

Dose.—Its toxic properties being very slight, as many as 5 or 6 capsules, containing 2 grains each, can be taken daily, but it is necessary to guard against gastric disturbance.

Physiological Action.—Cider has long been believed by the laity to have some effect on calculous formations, and this seems to be borne out by the fact that valerianate of amyl really has some solvent action on cholesterin. It is a colorless liquid, of pleasant taste when taken in small quantities, and can be prepared in the laboratory by the action of valerianic acid on amylic alcohol. Fifteen grains of cholesterin are dissolved by 70 grains of valerianate at 99° F., and by 46 grains at 104° F.

Therapeutics.—Physiologically, its action resembles that of ether, but the special qualities lie in its being a stimulant and sedative to the liver in cases of hepatic colic. It is said not only to immediately subdue the attack, but to prevent recurrences. If the stomach is irritable, it may be necessary first to employ sulphuric ether, following this with 2 or 3 capsules of 2 grains each, given every half-hour until the crisis is past, and continued at long intervals during the following days. According to Blanc, in nephritic colic the drug acts as an antispasmodic and general stimulant only, but no effect is produced on the renal calculi; muscular rheumatism is frequently relieved, and much benefit is also derived from its use during menstrual uterine contractions. It is also considered valuable as a sedative in hysterical manifestations.

ANÆMIA.—From Gr., ἀ, priv., and αἷμα, blood.

Definition.—A symptomatic disorder of the blood characterized by a deficiency of some of its important constituents, especially red corpuscles.

Varieties.—Anæmia may be classified into two general forms: (1) that due to defective hæmolysis and (2) that due to defective hæmogenesis. Stephen Mackenzie recognizes four degrees of anæmia according to the number of red corpuscles present in the blood, but, with other observers, he regards the classification given by Hayem, in which the proportion of hæmoglobin in the corpuscles is taken as a standard, as more scientific. This is especially the case, since the number of red blood-corpuscles has not been considered as important a factor as it was once held to be.

According to Germain Sée, alterations of the blood in true anæmia are conformable to one of three types: (1) the anæmia from hæmorrhage, characterized by a diminution *in toto* of all the elements of the blood; (2) a type characterized by hypohæmoglobinæmia,—*i.e.*, a deficiency of hæmoglobin, either quantitative or qualitative; (3) a type in which the number of red blood-corpuscles is reduced.

Symptoms.—The main symptom of this condition is an abnormal pallor of the skin and mucous membranes, which varies in different cases from yellow to absolute whiteness. The finger-nails also show, by their whiteness, the general condition present. The pallor is associated with various phenomena indicating involvement of the nervous system. Marked depression of physical and men-

tal powers is evident; there is tendency to inertia or indolence, especially during digestion. Inordinate palpitations are frequent, this condition causing, in the patients, a state of continuous fear as regards the presence of heart disease and anxiety concerning their general health. Shortness of breath on exertion, headache, and, in women, menstrual disturbances, amenorrhœa especially, and constipation, are also complained of. The surface of the body is cool and the extremities are usually cold. Sensitiveness to the variations of temperature is the rule.

The urine has a low specific gravity through deficiency of urea. The globes of the eyes may appear blue, owing to semitransparency of the conjunctiva.

Auscultation over the vessels of the neck reveals a venous hum; this symptom is often absent in mild cases, however. A systolic bellows-murmur is also frequently heard over the carotid arteries. A systolic murmur is occasionally heard over the aorta and the pulmonary artery. These are valuable guides when the effects of treatment are to be closely watched, their intensity varying with that of the degree of anæmia present.

Alterations in the size of the heart in anæmic subjects. Dilatation is commonly met with, and sometimes, especially in chlorosis, elevation of the diaphragm displaces the heart upward and an apparent dilatation is found. Anæmic dilatation is to be considered true idiopathic dilatation resulting from overstrain. None of the usual symptoms are present; gastralgia alone is complained of. Wybauw (Jour. Méd. de Bruxelles, Mar. 15, 1900).

Anæmic dyspnœa is mainly due to vasomotor failure; the disease is prevalent in the female sex, whose vasomotor system is more unstable than that of the male; it usually occurs at puberty, when this system is unusually active. J. Henton White (Birmingham Med. Rev., Oct., 1900).

Case of simple anæmia in a young mulatto in which the disease followed pregnancy. On admission, examination of the blood showed 12 per cent. of hæmoglobin, 750,000 blood-cells, and 33,000 white cells. The case is classed as one of simple anæmia because of the rapidity and degree of the recovery. Floyd and Gies (Med. Record, Apr. 27, 1901).

Case in a woman, aged 38 years, who had suffered from anæmia for twelve years, attended by repeated nasal discharge of blood and pus. Examination of the blood showed 23 per cent. of hæmoglobin, 475,000 red blood-corpuscles, 1400 white corpuscles, color index of 2.40, and the presence of nucleated red cells, both normoblasts and megaloblasts. Under treatment a great improvement resulted, but a recurrence of the blood-disorder took place and death resulted. The case is thought to have been one of secondary anæmia which had passed into pernicious anæmia. W. Edgecombe (Brit. Med. Jour., May 4, 1901).

Differential Diagnosis. — The symptomatic evidence is such, in the majority of cases, as to readily suggest the true nature of the disease. It is to be differentiated from the more severe forms: chlorosis, pernicious anæmia, leucocythæmia, and pseudoleucocythæmia.

Chlorosis. — The greenish pallor of this disease is quite characteristic. The reduction of hæmoglobin is disproportionate as compared to the number of red cells, which is not, as a rule, greatly reduced.

Pernicious Anæmia. — Examination of the blood is required to thoroughly establish the diagnosis, although the lemon-colored skin peculiar to these cases is quite distinctive.

Leucocythæmia. — The diagnosis is early established by the microscope, which shows the increase of white corpuscles, their ratio to the red corpuscles

being sometimes 1 to 30 instead of 1 to 600, the normal proportion.

PSEUDOLEUCOCYTHÆMIA.—In this disease the presence of enlarged glands is characteristic.

Etiology. — The principal causes of benign anæmia are: (1) loss of blood, hæmorrhages; (2) improper assimilation of nutritive products or insufficiency of blood; (3) abnormal expenditure of blood-constituents, as in pregnancy and lactation. The first etiological factor is especially common in women, menorrhagia, metrorrhagia, and abnormal bleeding during labor being the most frequent causes. The second class affects the poor, in the majority of instances, through lack of proper food, insufficient sunlight, and crowded quarters, to which exposure to a vitiated atmosphere the greater part of the time is added. The third class of cases, those due to pregnancy and lactation, are frequently met with, and explain, with the other causes, the greater frequency of anæmia in women than in men. The latter, however, are more exposed to another class of causes,—that due to introduction into the system of such toxic agents as lead, malaria, etc.,—which also tend to cause organic alterations of the blood-constituents.

Anæmia occurring in anchylostomiasis is often due to the habit frequently associated with the disease: of eating dirt. This often gives rise to œdema of the face and feet, anæmia, emaciation, and exhaustion. A. J. B. Duprey (Lancet, Oct. 27, 1900).

Histories of four of fifteen cases of splenic anæmia described in a previous paper. The etiology of the disease is not known. Heredity usually plays no part; but Brill has reported three cases in one family. Among the symptoms are, first, the remarkable duration of the disease; the enlargement of the spleen without apparent cause; the hæmatemesis recurring for a number of years; the anæmia, which is characterized by a moderate reduction of the number of corpuscles, a great reduction in the percentage of hæmoglobin, and leucopenia. There is often pigmentation or bronzing of the skin. In some of the patients cirrhosis of the liver occurs, and in a small number ascites is present. Among the other symptoms jaundice sometimes occurs. The condition found in the spleen is chiefly a fibrosis or hyperplasia, with atrophy of the pulp and hyaline degeneration of the Malpighian bodies, or a change by which the normal texture is largely replaced by fibrous tissue and large endothelial cells with clear protoplasm containing two or more nuclei, and among them giant cells. The disease probably represents a chronic toxic, rather than an infectious, process. The best name is probably splenic anæmia. The treatment consists in splenectomy. In the author's series it was performed on three patients, two of whom died as a result of the operation. W. Osler (Amer. Jour Med. Sciences., Nov., 1902).

Pathology.—There may be a diminution of the quantity of the blood in the system, a deficiency of hæmoglobin, and reduction of the number of red corpuscles or of other constituents of the blood, all of which are to be determined by careful examination. The quantity of hæmoglobin is not always proportionate to the number of red corpuscles, the percentage of hæmoglobin in the latter being subject to variation according to the character of the disease present. In the benign form of anæmia treated of in this article, examination shows but a slight diminution of the number of red corpuscles and a relative reduction of hæmoglobin.

Repeated experiments showing the same result, that the production of the hæmoglobin and the increase in the number of red corpuscles depend upon different factors, certain substances increasing one while others increase the other.

Arsenic certainly increases the number of red blood-cells, while iron causes the production of new hæmoglobin. F. Aporti (Centralb. f. innere Med., Jan. 13, 1900).

Basophile granules. To determine whether they result from the degeneration of the nuclei or the cell-protoplasm itself, an artificial anæmia was established in several rabbits by drawing off as much as one-third of their blood. The granules were not found at once after venesection, but appeared one or two days later, chiefly in polychromatophilic cells, and many of these without granules were also apparent. The late appearance of these changes speaks for cell-degeneration, rather than breaking down of the nucleus. It is known that large losses of blood are followed after several days by an hydræmic condition of the circulating fluid. This is also seen in all forms of anæmia except chlorosis, and it stands in definite relation with and is the chief causative factor in the cell-changes. M. Cohn (Münchener med. Woch., Feb. 6, 1900).

In all cases of anæmia uncomplicated with glandular involvement there is an increase in the percentage of lymphocytes and correspondingly a diminution in the quantity of the multinuclear neutrophile elements. Leucopenic anæmias associated with glandular disease (spleen, lymphatic glands) show a varying quantity as to the relative percentage between the multinuclear and uninuclear elements. A. V. Decastello and Ludwig Hofbauer (Zeits. f. klin. Med., vol. xxxix, Nos. 5 and 6, 1900).

Treatment.—The treatment of benign anæmia may be summed up as follows: (1) on removal of the cause, if such be found; (2) on exercise of hygienic measures,—light, air, rest, and exercise; and (3) on proper medication. Of drugs, iron stands first, and is especially useful where hæmoglobin is greatly reduced. Next to iron is arsenic: useful particularly where hæmoglobin is not so much reduced as the corpuscles.

Experiments on dogs and chickens and search through literature show that copper, zinc, manganese, and mercury act like iron in cases of anæmia and chlorosis. Under their use the hæmoglobin readily increases. Cervello (Jour. des Praticiens, Jan. 12, 1901).

Anæmia being in reality but a symptom, the causative affection must be carefully sought after. In women, as stated, uterine disorders are the most active factors. In young girls it is frequently met with, owing, probably, to temporary inequality in the development of various physiological functions. Hence the infrequency of complications in such cases. The possibility of complications should always be borne in mind, however, and every precaution taken to forestall aggravated forms, by food adjusted to the taste of the patient and made attractive to her. Disorders of digestion usually yield to bismuth and aromatic powder.

As result of investigations into effect of exercise on hæmoglobin with reference to the value of rest and treatment of anæmia, it is concluded that (1) there is a normal daily fall and nightly rise in the worth of the corpuscle, representing a daily destruction and regeneration of hæmoglobin; (2) active exercise increases the extent of the daily fall and the nightly rise; (3) active exercise stimulates a slight overproduction of hæmoglobin; (4) passive exercise [massage] diminishes the volume of the blood, but has no effect in diminishing or increasing the amount of hæmoglobin; (5) rest reduces the extent of the daily fall in worth, representing a diminished destruction of hæmoglobin. Wilfrid Edgecombe (Brit. Med. Jour., June 25, '98).

Although iron is especially effective after the cause of the disease has been removed, even when the causative ailment is still present it exercises its beneficial effects, which are generally ascribed to the fact that iron is a normal constituent of the red corpuscles.

As regards the best preparation to be employed, it is difficult to make a selection. Theoretically, the best preparation, according to Herschell, is the nascent ferrous carbonate formed in the stomach itself by the reaction between sulphate of iron and carbonate of potash, while the worst preparations are the albuminates, peptonates, and colloid forms. In the latter, contact with the hydrochloric acid of the gastric juice produces a precipitate of insoluble ferric carbonate of iron. The alleged fact that these preparations are better borne in disease is evidently due to the fact that they are almost inert. In a comparative study of the subject, during which the hæmoglobin was estimated both before and after treatment by means of Fleischl's hæmometer, Herschell found Blaud's pills in tabloid form to be the most effective, having shown an average daily increase of 1.2 per cent. of hæmoglobin. Ferratin has also been recommended by many observers. Banholzer observed a 5-per-cent. increase of hæmoglobin in eight days. Whatever preparation is used, it should be changed for another after a few weeks and returned to, if its effects have manifested themselves actively. The remedy should invariably be administered after meals. Anæmic patients are usually imaginative and frequently assume that iron will not improve their condition. They must be assured that they will be benfited provided the instructions given them are carefully carried out.

Iron exists in the blood only in the form of a phosphate. Soluble citrophosphate of iron, for the production of this salt, is not followed by constipation. Jolly (Provincial Medical Journal, May, '89).

Albuminate of iron is especially serviceable when anæmia and debility are associated with weak and irritable digestive organs. John A. Ouchterlony (Amer. Pract. and News, Nov. 23, '89).

Blaud's pills preferred to any other preparation of iron; next to iron comes arsenic. Arsenic acts with most effect in cases in which the relative percentage of hæmoglobin remains normal or is actually increased, the type of which is pernicious anæmia. Laache (Wiener klin. Woch., Sept. 18, '90).

The double sulphate of iron and magnesium recommended in doses of 10 grains three times a day.

℞ Sulphate of iron and magnesium, 2 drachms.
Chloroform-water, enough to make 6 ounces.

M. Sig.: Half an ounce three times a day. Woods (Brit. Med. Jour., May 23, '91).

Daily dose of ferratin for adults is 15 to 23 grains. Schmiedeberg (Arch. f. exp. Path. und Pharm., B. 23, H. 23, '94).

In anæmia following acute disease hæmoglobin quickly increased (over 5 per cent. in eight days), also number of red cells, by the use of ferratin. Banholzer (Centralb. f. klin. Med., Jan. 27, '94).

In marked anæmia and chlorosis Blaud's pills in large doses recommended. As many as forty-eight on the fourth day have been given and continued for three or four weeks. It is necessary to keep the patient in bed in a large, airy room; hospital patients are more likely to recover quickly than private ones for this reason. Byrom Bramwell (Med. Record, Aug. 22, '97).

The most satisfactory result is obtained with the peptomanganate of iron; it is easily absorbed by the entire intestinal tract, and evokes no concomitant effects. In 12 out of 23 cases the hæmoglobin was normal after fourteen days, in 5 after three weeks, and in 5 after a month. In acute anæmia good results were also obtained by this mode of treatment. H. Metall (Med.-Chir. Centralb., June, 1902).

Some cases do not yield to the preparations of iron as long as constipation exists. Aperients may either be given separately or with the iron. Aloin and

belladonna extract are useful in these cases.

Iron and rhubarb may be combined as follows:—

℞ Protoxalate of iron,
Powdered rhubarb, of each, 1 grain.

Make into a cachet. Give two or three of these cachets each day. Editorial (Jour. des Praticiens, Mar. 28, '96).

Iron may be administered hypodermically. This method is of great value when the anæmia is far advanced and a sudden reaction becomes necessary.

The subcutaneous injections of iron salts in the form of a 10-per-cent. solution of iron and ammonium citrate, 1 grain and upward of the drug being given in each injection, tried. In every instance in which the injections were continued sufficiently long, the percentage of hæmoglobin regularly increased, and simultaneously the phenomena of anæmia, both subjective and objective, decreased. This shows that the anæmic condition can be markedly benefited by iron when given subcutaneously. Riva-Rocci (Il Policlinico, No. 8, p. 168, '96).

Case of grave anæmia in which prolonged treatment with many preparations of iron and arsenic taken internally produced no effect. The hæmoglobin sank below a sixth of its normal amount. The patient apparently dying, subcutaneous injections of a 4-per-cent. solution of citrate of iron tried, 45 to 60 minims being injected daily. Marked improvement took place almost at once, and the percentage of hæmoglobin rapidly rose. In a month's time the patient was convalescent.

A 4-per-cent. solution is quite strong enough. The 10-per-cent. solution generally employed is too strong. Hypodermic injections of 3 grains of citrate of iron have been known to cause vomiting and fever. The kidney is liable to be damaged by too concentrated solutions, leading to anuria and hæmaturia and even nephritis. Hypodermic injections of iron are not indicated in cases where the kidneys are not sound. R. Lépine (La Semaine Méd., May 26, '97).

While iron is the most active of the chalybeates, other drugs tend to increase blood-formation, namely: manganese, phosphorus, arsenic, hydrochloric acid (indirectly), and oxygen. Manganese sometimes proves useful when amenorrhœa is present. Phosphorus and arsenic encourage nutrition and probably act as germicides, preventing ptomaine formation in the intestines.

Waters containing small quantities of iron give better and quicker results than pharmaceutical preparations, and all the unfavorable symptoms so often produced by the latter are avoided. Th. Bernard (Gaz. Méd. de Paris, Apr. 8, '93).

Iron increases in a marked degree oxidation, while arsenic, on the contrary, exerts a powerful moderating influence on this process. The indications for one of these drugs are consequently exactly the opposite of those of the other. Treatment by iron is called for in cases of anæmia with reduced co-efficient of oxidation, whereas arsenic should be ordered when the oxidation is increased. A. Robin (Med. Week., Apr. 2, '97).

Case of a girl of 20 who had tried all remedies recommended in anæmia, but without effect. Nettle-soup ordered first, every second day; then, when she improved, twice a week. Patient was completely cured. The author himself was cured of anæmia, when he was 17, by taking nettle-soup. The common or stinging nettle (*Urtica dioica*) and the dwarf nettle (*Urtica urans*) possess the same virtues, but the first is used almost exclusively. The best time for collection is spring: the best part to use is the roots and stalks with only half-developed leaves. It may be used as an infusion—a handful to two quarts of water, 2 or 3 glasses of this to be taken during the day; but it is much pleasanter to use in the form of a freshly-prepared soup from the fresh herb. Hjalman Agnér (Bull. Gén. de Thér., June 8, '98).

Hæmoglobin continued until the normal standard is reached—1 $^1/_2$ grains daily—has met with favor. If there is no digestive trouble, other preparations

of iron can be given at the same time, and the results be more prompt.

Hæmogallol, the dose of which is 1 grain, given a quarter of an hour before meals gradually increased to 1 $^1/_2$ grains and over, has been recommended by T. Lang and others.

A number of agents have been recommended with the view to lessen the destruction of blood-corpuscles; arsenic, quinine, mercury, phosphorus, betanaphthol, iodoform, carbolic acid, sulphocarbolate, and menthol represent this series. Arsenic probably accomplishes this in the manner indicated, namely: by preventing the formation of ptomaines.

Direct transfusion of blood is also of value in cases of chronic progressive anæmia, by stimulating the blood-making organs. This measure is sustained by von Ziemssen.

The introduction of goat's serum directly into the veins, using about 50 cubic centimetres (1 $^3/_4$ ounces) has been advocated by Lépine.

Striking curative results have been obtained by Simon Baruch, by means of hot-air baths in boxes, followed by cold douches.

> Hot baths in more than fifty cases of anæmia in patients who for the most part had been under medical treatment without benefit. A bath at 104° F. is given three times a week. Its duration should not exceed fifteen minutes, and at its close the patient should be douched with cool water. Immediate effect of such a bath is a feeling of lightness in the individual, and in four weeks' or a less time there is a noticeable improvement in the general condition. Rosin (Centralb. f. innere Med., Apr. 30, '98).

Hayem in 1889 recommended the hypodermic injection of arsenical preparations in cases where irritability of the stomach prevented its administration by the mouth. The best means of administering Fowler's solution is in cherry-laurel water, in 10-drop doses, as much as 20 drops being sometimes given in a day.

> Report of thirty-five cases of severe anæmia due to various causes—such as pernicious anæmia; anæmia after typhoid fever, round ulcer, cancer, tuberculosis; and that due to tape-worm—in which a solution composed of 2 parts of water and 1 part of Fowler's solution was employed. Of this mixture, an ordinary hypodermic syringeful was given daily. In all instances a marked improvement in the anæmia noted. Kering (Jour. des Praticiens, Jan. 18, '96).

Oxygen does not possess the confidence of the profession, although some rather remarkable cases have been reported.

> [Nothing is to be expected from oxygen, for the blood-corpuscles, few in number though they be, are well charged with hæmoglobin and consequently with oxygen. In chlorosis the case is different. F. P. Henry, Assoc. Ed., Annual, '89.]
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> In marked anæmia and chlorosis the inhalation of oxygen has been tried, but without much benefit. F. Taylor (Med. Record, Aug. 22, '97).
>
> Series of cases in which oxygen inhalations with marked benefit were used. The most interesting was that of a woman of 22 with grave anæmia, the red cells being reduced to 2,000,000, the hæmoglobin to 30 per cent., and the red cells were much deformed. The woman had frequent attacks of syncope and was very weak. Upon the failure of iron and arsenic treatment she was given oxygen inhalations, and rapidly improved. Within four months the red cells had increased to 4,000,000, and the hæmoglobin was about normal. She ultimately became entirely well. The apparatus which is recommended is similar to the one used for the administration of nitrous oxide. P. G. Lodge (Lancet, Apr. 7, 1900).

Insomnia is a frequent accompaniment of anæmia and tends greatly to increase the weakness of the patient. Amylene-hydrate is the best agent in this condi-

tion, 30 to 45 minims being administered in capsules on retiring.

In insomnia of anæmia, amylene-hydrate. For adults the dose is 30 to 45 minims by the mouth, or 40 to 75 minims by the rectum. It should be administered by the mouth in soft capsules, or in a solution disguised by some aromatics. The mixture should be well shaken before use, to avoid an overdose. W. H. Flint (Ther. Gaz., Jan., '90).

Submammary infusions of salt solution in primary anæmia from hæmorrhage, in shock, were recommended recently by J. G. Clark. As a stimulant after severe blood-loss or shock, its benefits are so marked, and the procedure so free from bad results of any kind, that it has been used with signal success by Howard Kelly, of Baltimore, in 41 of the last 225 cases of abdominal section in the Johns Hopkins Hospital.

A quart of 0.6 sterilized solution of common salt is used, and is infused into the submammary cellular tissue in the following manner: A bottle containing the solution is connected by five feet of rubber tubing to a slender aspirating-needle. The breast, after being carefully disinfected, is grasped and lifted well from the thorax, while the needle, with the fluid flowing from it, is quickly thrust beneath the gland. Usually simple elevation of the bottle is sufficient to force the fluid into the loose cellular tissue; if this be insufficient, stripping the tube or the reversed aspirator pump can be used. The breast rapidly distends, and in some instances the fluid may actually spurt from the nipple. After a quart has been injected, the needle is rapidly withdrawn and the puncture closed with adhesive plaster. In thirty minutes complete absorption has taken place. Manifest improvement in the patient's condition is rapidly apparent, especially with regard to pulse, which shows greater volume and strength, while the patient herself feels better and is brighter. A critical stage occasionally occurs in some cases within half an hour. This consists in a violent chill, with sensations of extreme cold, rise in temperature, and strong, rapid pulse; but this is followed by a marked reaction. From its safety this procedure is strongly to be recommended instead of arterial or venous infusion. J. G. Clark (Amer. Jour. Obst., June, '97).

Subcutaneous injections of the arsenate of iron valuable in anæmia. In a previous article the author has shown that injections of iron salts, if continued for a sufficient length of time, produce very constant and trustworthy results in anæmia. The arsenate of iron used because the addition of arsenic improves the action of iron. This method of treatment used in a large number of cases and considered the best mode for administering iron. The author employed the solutions prepared by Zambeletti, in which the arsenate was perfectly dissolved. The injections were made preferably into the nates, with the usual aseptic precautions, by means of a syringe with a rather long needle. The doses were gradually increased until about 60 or 80 injections had been given, when the doses were gradually diminished again. Toward the end of the treatment the injections were alternated with the administration of iron, arsenic, and phosphorus, as well as nux vomica or strychnine by mouth, the latter being continued for some time after the injections were abandoned. The results obtained with this method of treatment were uniformly satisfactory in a large number of cases. Nicola Fedele (Gaz. degli Osped. e delle Clin., Feb. 1, 1903).

Bone-marrow has been tried in anæmia, with varying results. This subject is reviewed under ANIMAL EXTRACTS.

ANÆMIA, PERNICIOUS.

Definition.—A form of anæmia which tends toward a fatal issue.

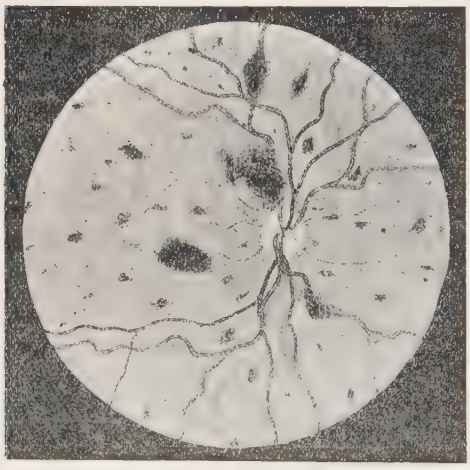
Symptoms.—The most evident symptom is extreme pallor of the face and body, which gradually assume a lemon-yellow tint. This yellowish color deepens as the case progresses; it may appear suddenly, but in the majority of cases it

develops gradually, following the insidious course of the disease.

There is great weakness with all its attending symptoms: inordinate palpitations and dyspnœa on exertion, sighing, and slow delivery in speaking.

The pulse is regular, but rapid, in the majority of cases, more or less fever being usually present. The temperature is extremely irregular.

Cardiac murmurs are generally heard, and signs of fatty degeneration may be detected by auscultation, although there



Fundus oculi in a case of pernicious anæmia, showing retinal hæmorrhages. (*Bramwell.*)

is usually no arterial degeneration or valvular disease. A loud venous hum can sometimes be detected in the vessels of the neck. Œdema of the ankles, face, and lungs and dropsical effusions may appear at any stage.

Retinal hæmorrhage is a symptom of great value. There may also be hæmorrhages into the mucous membranes, epistaxis, menorrhagia, and purpuric eruptions in advanced cases.

Gastric and intestinal disorders are the rule, although the general nutrition is apparently preserved, the appetite being sometimes voracious, and the patient becoming obese. Dyspepsia, vomiting, and diarrhœa usually prevail. The gastric region is tender to pressure, and the tongue is pale and smooth.

Involvement of the osseous system is occasionally indicated by sensitiveness of the bones, especially those of the sternum.

Drowsiness is present in the majority of cases, but insomnia is occasionally observed.

Headache, vertigo, tinnitus, apoplectiform attacks, delirium, and other disorders of the nervous system, such as paræsthesia, neuralgia, and extensive paralyses, have been noted.

Absence of the knee-jerk is often present, and is indicative of degeneration of the posterior columns of the cord.

Jaundice is occasionally met with.

The urine is dark and highly colored; it is of low specific gravity, and shows an increase of urea and uric acid and pathological urobilin.

When the end is approaching the temperature recedes markedly, and the patient enters into a torpid condition, ending in coma.

Diagnosis.—While pernicious anæmia possesses characteristics that readily distinguish it from other blood affections, —the color of the skin, the retinal hæmorrhages, etc.,—the early stages are generally such as to suggest diseases that do not present the same degree of danger.

Benign Anæmia. — Intractability of the disease, after the removal of supposed causes and the faithful use of appropriate measures of treatment, strongly suggests the presence of pernicious anæmia.

Chlorosis.—From this affection pernicious anæmia may readily be differentiated by the blood-examination. Instead of relative increase of hæmoglobin,

the presence of gigantoblasts, marked oligocythæmia, and macrocytes differentiate. The red corpuscles, in chlorosis, may be normal in number and in size, the only change being a deficiency of hæmoglobin. Again, the corpuscles may be normal in number, but diminished in size, while the percentage of hæmoglobin is normal; finally the corpuscles may be diminished in number with either a diminished, normal, or perhaps an increased percentage of hæmoglobin.

LEUCOCYTHÆMIA. — This disease may be excluded by the absence of the characteristic blood-change: excess of white corpuscles.

PSEUDOLEUCOCYTHÆMIA is excluded by the absence of the affection of the lymphatic glands which characterizes this disease, more commonly known as Hodgkin's disease.

LEUKÆMIA.—In leukæmia the patient often does not show enough pallor to make the physician suspect the disease. The lips have a dirty-red color rather than a peculiar pallor. The number of white corpuscles would cause pallor in a patient with simple anæmia, but in this disease the opacity of the blood is great and the pallor fails to show. (Janeway.)

GASTRIC CANCER. — This condition almost always shows itself after the age of forty years, whereas pernicious anæmia is generally observed early in life. In cancer the skin is pale; in pernicious anæmia the peculiar lemon color is striking in the majority of cases. While gastric symptoms and absence of hydrochloric acid are prominent features of cancer, the digestive disorder is slightly marked in anæmia and examination of the gastric contents is negative. Finally increasing emaciation attends a cancerous disorder, whereas in cases of pernicious anæmia the patient not only retains his adipose tissues, but sometimes becomes corpulent. In rare cases, however, there was extreme emaciation.

> The difference between the pernicious anæmia and other grave anæmias lies in the clinical course, that of the former being characterized by the fact that, even after the removal of the apparent cause, the hæmapoiesis persists in a faulty direction, manifested by insufficient new formation and perhaps increased destruction of corpuscles. There is in this disease then a morbid cell-activity that tends to persist with great pertinacity in the wrong direction. E. Grawitz (Berliner klin. Woch., Aug. 8, '98).
>
> Pernicious anæmia is a disease of the blood and of the blood-forming organs. Hence the diagnosis must be essentially based upon the condition of the blood. Of all the morbid changes which occur in this tissue, the most important is the presence of megaloblasts. In twenty-nine cases of the malady observed by the author, only in one could these large corpuscles not be found on repeated examination; in the remaining twenty-eight they were present, and in the majority of instances could be detected on the first examination. Naegeli (Wiener med. Wochen., Aug. 22, 1903).

Etiology.—Although the disease occasionally occurs in children, it is most common in adults between the ages of twenty and forty years.

Males are attacked more frequently than females, with a slight difference in favor of the former. The disease is more prevalent among the better than in the lower classes, and is most common in Europe, especially in Switzerland: *e.g.*, in regions in which the people are badly fed, and who live in poorly-ventilated and badly-lighted houses. Fright and grief are prominent etiological factors.

> The following group of etiological factors has been established in pernicious anæmias: 1. Gastro-intestinal disease of long standing, poor food, impaired digestion; chronic constipation, especially in women frequently pregnant; irregular defecation in women and girls, especially

those of hysterical temperament. In such cases it is due to intoxication from the gastro-intestinal tract. 2. Pregnancy. Here, too, probably, there is an autointoxication from the intestinal tract, on account of pressure exerted by the gravid uterus on the bowel. 3. Chronic hæmorrhages, especially of small size. 4. Constitutional syphilis, particularly when associated with sclerosis of the marrow of the long bones. 5. Bad hygienic conditions of various kinds, especially in the female sex; hard work, with insufficient food, bad air, and emotional excitement. In higher social strata the disease may be found in women who are subjected to intense mental strain as the result of a desire to equal men in physical efforts. Frequent pregnancy and prolonged lactation are also factors. 6. Chronic poisoning, as, *e.g.*, by carbon monoxide. 7. Bothriocephalus and anchylostomum—those cases belong here that are not cured after the expulsion of the worms. E. Grawitz (Berliner klin. Woch., Aug. 8, '98).

Scarcity of hæmatoblasts and loss of contractility of blood-clots are the most important signs. In severe anæmia it is usual to find that some nucleated red blood-corpuscles are present; but, apart from leucocythæmia and from blood infections, such corpuscles are not merely scarce, but are also of small size. Hayem (La Presse Méd., Oct. 7, '99).

In 110 personal cases of pernicious anæmia, there were 57 males and 53 females, and only four cases followed parturition. Late middle life predisposed to it, as shown by the fact that in 82 of the cases the patients were over 40 years of age. Pernicious anæmia is much more frequent than the text-books would lead one to suppose. Some cases had previously been diagnosed as tuberculosis. There was very little, if any, relation between the menopause and pernicious anæmia. It had nothing to do with syphilis. Hæmorrhage was quite common, especially of the nose and gums. The striking constancy of the symptoms in almost all cases, even in some of the so-called mild ones, was noted, viz.: muscular weakness, dyspnœa, gastro-intestinal disturbance (paroxysmal diarrhœa). The appetite was poor in all but three cases, and in these it was ravenous. In two-thirds of the cases there had been a temperature of 99° to 100° F., and even higher. The urine in 53 cases was normal, while others had had a trace of albumin with granular casts. Nervous symptoms had not been constant. Some cases had had myelitis. As to the blood, the white corpuscles were subnormal; the number of red corpuscles was 2,500,000. The diameter of the white corpuscles was greater than normal. The proportion of lymphocytes was relatively high. There was no relationship between the symptoms and the blood condition. The average duration of this disease was from one to two years. The longest-lived case was five years. All treatment was hopeless, unless the use of laxatives would be of service, working along the line of Hunter's idea, that of gastro-intestinal toxæmia. Arsenic did little, if any, good in these cases. R. C. Cabot (Med. Record, May 12, 1900).

Pregnant women represent the largest proportion of cases. Repeated parturition is probably the most prolific cause of the disease, for it is seldom met with in primiparæ. Excessive and prolonged lactation and puerperal hæmorrhages and other exhausting conditions frequently appear as the primary element in the causation of the disease.

Certain atrophic conditions of the gastric mucous membrane, ulcers of the stomach, malaria, syphilis, cancer, and alcoholism have also been considered as etiological factors.

Infection through solutions of continuity or purulent foci may possibly act as a primary cause.

Intestinal parasites—the anchylostoma duodenale and the bothriocephalus latus—are also considered as possible etiological factors.

Of twenty-three native African negroes, representing various parts of East and West Africa, the following parasites were found: Anchylostoma duodenale,

twenty-one times; trichocephalus dispar, eight times; ascaris, eight times; anguillula stercoralis, four times; tæniæ, four times; amœbæ, twice. *The negroes showed no sign of anæmia,*—so striking a symptom in Europeans with anchylostomiasis. Zinn and Jacoby (Berliner klin. Woch., No. 36, '96).

Variations in nitrogenous metabolism of 21 cases of bothriocephalus anæmia occurring at the Helsingfors medical clinic. In all cases there was a distinct nitrogen loss up to 8.8 grammes per day before the worm was expelled. Afterward the nitrogenous balance was at once or by degrees entirely regained. In some cases there was retention of nitrogen. The writer ascribes the increased nitrogen output to the action of a toxin produced by the worm upon albuminous matter. No parallel was found between the blood conditions and the nitrogenous excretion. With a purin-free diet the urinary purin excretion showed marked variations. During the toxic period—that is to say, while the worm was present in the intestines—the endogenous purin excretion was very large. When the worm has been removed, the quantity of purin excreted sank rapidly to the normal. In some cases, however, it continued high for some days after the expulsion of the worm. The toxins secreted by the worm evidently incite leucocytosis to a high degree, and also extensive destruction of nuclear matter. E. Rosengrist (Zeit. f. klin. Med., Bd. xlix, 1903).

Pathology.—The two prevailing theories as to the pathogenesis of pernicious anæmia are the following: 1. That the disease is due to breaking up of the blood-corpuscles (hæmolysis). 2. That, owing to some defect in the blood-making (hæmogenesis), the blood becomes vulnerable to the destructive influence of micro-organisms.

Alterations in the size of the heart in anæmic subjects. Dilatation is commonly met with, and sometimes, especially in chlorosis, elevation of the diaphragm displaces the heart upward and an apparent dilatation is found. Anæmic dilatation is to be considered true idiopathic dilatation resulting from overstrain. None of the usual symptoms are present; gastralgia alone is complained of. Wybauw (Jour. Méd. de Brux., Mar. 15, 1900).

Anæmic dyspnœa is mainly due to vasomotor failure; the disease is prevalent in the female sex, whose vasomotor system is more unstable than that of the male, it usually occurs at puberty when this system is unusually active. J. Henton White (Birmingham Med. Rev., Oct., 1900).

The cord and nerve changes sometimes met with probably result from the same irritant. These, with the irregular course, fever, and gastro-intestinal disturbance, indicate a toxic cause. The general condition does not seem to bear any definite relation to the blood-state, at least as far as the number of erythrocytes is concerned, for one individual with only 1,000,000 per cubic millimetre may be capable of prolonged efforts, while another with 4,000,000 may be weak and easily exhausted. Weakness, then, is not proportionate to the anæmia, is often the earliest symptom complained of, and may precede the pallor. McPhedran (Lancet, Jan. 19, 1902).

Deficiency of red corpuscles (oligocythæmia) is always very great; the blood is, therefore, pale and thin, resembling sherry-wine. The oligocythæmia is sometimes so marked that the normal proportion of 5,000,000 red corpuscles to the cubic millimetre is reduced to one-twenty-fifth of that number. Quincke reported a case in which there were only 143,000 to the cubic millimetre immediately before death.

The hæmoglobin is also greatly reduced (oligochromæmia), but not in proportion with the cell-reduction. The hæmoglobin percentage was greater by 10 per cent. in a case seen by Osler.

Emphasis upon the reduction in the number of the red blood-corpuscles. There is no disease, except pernicious

anæmia, in which the number of red corpuscles is at any time reduced below 20 per cent. This affords a distinction between pernicious anæmia and latent gastric cancer: a disease with which the former is most likely to be confounded.

The relatively high percentage of hæmoglobin depends upon increased average size of the corpuscles and in some cases on the presence of an unusual number of highly colored and minute microcytes. It also depends, in a measure, upon the time at which the examination is made. The icteric color of the skin and the dark urine are caused by dissolution of the red blood-corpuscles, and the hæmoglobin estimated at one of these periods will thus be higher, owing to the more highly colored plasma. The red blood-corpuscles show marked signs of reversion to the type of blood which is normal in the cold-blooded animals. F. P. Henry (Amer. Jour. of Med. Sciences, Aug., 1900).

Besides the above, there is a species of degeneration closely resembling coagulation-necrosis, and an alteration of the corpuscles, characterized by the appearance in their interior of one or two corpuscles composed of modified hæmoglobin,—*dégénération hémoglobinémique.* The process of regeneration is manifested by the presence of nucleated red corpuscles, which are divided by Ehrlich into two varieties: the normoblasts and the megaloblasts, the former corresponding to the hæmatinic evolution of adults, the latter to that of the embryo. The nucleus of the normoblast is extruded to form a new red corpuscle, while the nucleus of the megaloblast is absorbed.

Fresh blood shows nucleated red corpuscles of large size, divided by Ehrlich into megalocytes and gigantocytes. Others are termed macrocytes.

Fürbringer has shown that a case is to be considered as one of true pernicious anæmia only when one-fourth of the red corpuscles are macrocytes.

The presence of megaloblasts is a sign that certain pathological changes are taking place in the red marrow rather than a distinctive feature of pernicious anæmia. The macrocytes and metrocytes are more characteristic of pernicious anæmia, because they are the direct precursors of the large red marrow-cells. Engel (Wiener med. Woch., No. 20, '98).

By the subcutaneous injection of the muriate of phenylhydrazin into animals a condition of the blood similar to that in pernicious anæmia is obtained. The view that pernicious anæmia is a true hæmoglobinæmia questioned. S. Kaminer and R. Rohnstein (Berliner klin. Woch., July 30, 1900).

Misshapen corpuscles (poikilocytes) are very frequently observed, oftener, indeed, than in any other affection.

Many small, imperfectly developed corpuscles (microcytes) are generally found.

In marked cases corpuscles endowed with motion are occasionally observed.

Red blood-corpuscles of normal blood are motionless. The elements observed in cases of high degree of anæmia are endowed with four kinds of motion: 1. A movement of the entire mass of the corpuscle. 2. The projection of mobile prolongations. 3. A movement of oscillation, manifested slowly by minute corpuscles. 4. A movement which results in changing the position of the corpuscles. These movable corpuscles are bodies arrested in their evolution and still retaining the contractile properties of the hæmatoblasts from which the red corpuscles originate. On superficial examination they might readily be mistaken for parasites. Hayem (La Médecine Moderne, Feb. 26, '90).

[Several years ago I observed distinct movements in the red corpuscles in a case of pernicious anæmia, but made no public mention of the interesting fact. F. P. Henry, Assoc. Ed., Annual, '91.]

Large number of amœboid corpuscles found in fresh-blood preparations, larger than red corpuscles, and possessed of very active movements. Perles (Medical Press, June, '93).

[In view of the fact that the red blood-corpuscles of pernicious anæmia have been observed by Hayem and others to be possessed of amœboid movements, I would hesitate, in the absence of further proof, to regard the bodies described by Perles as other than degenerated blood-constituents. F. P. HENRY, Assoc. Ed., Annual, '94.]

Small, mobile bodies observed, staining the same as red corpuscles and resembling fragments of hæmatins, thought to possess pathognomonic value. Senator (Le Bulletin Médical, May 26, '95).

Study of fifty cases. Most typical points in the blood: 1. A reduction of the number of red cells to about 1,000,000. 2. The absence of leucocytosis. 3. Possibly a relatively high percentage of hæmoglobin in some cases. 4. Increase in average diameter of the red cells. 5. The presence of large number of polychromophilic red cells. 6. The presence of nucleated red cells, a minority being normoblasts. 7. The presence of myelocytes. 8. A relatively high percentage of small lymphocytes at the expense of the polymorphonuclear cells. Cabot (Boston Med. and Surg. Jour., Aug. 6, '96).

Pernicious anæmia is essentially a hæmolytic disease, the hæmolysis being due to some as yet unknown poison comparable in its effect on the blood and blood-organs to the action of toluylene-diamine—whether autointoxication or infection remains yet to be determined. The poison of pernicious anæmia stimulates the phagocytes of the spleen, lymph- and hæmolymph-glands, and bone-marrow to increased hæmolysis (cellular hæmolysis). Either the phagocytes are directly stimulated to increased destruction of red cells or the latter are so changed by the poison that they themselves stimulate the phagocytes. The hæmolysis of pernicious anæmia differs only in degree, not in kind, from normal hæmolysis or the pathological increase occurring in sepsis, typhoid, etc. It is not improbable that from the destruction of hæmoglobin poisonous products (histon ?) may be formed which has also a hæmolytic action; a vicious circle of hæmolysis may thus be produced. No proof of this exists at present. The hæmolysis of pernicious anæmia is not confined to the portal area, as according to Hunter, but in some cases at least takes place also to a large extent in the prevertebral lymph- and hæmolymph- nodes and bone-marrow. In the majority of cases the spleen is the chief seat of the blood-destruction. No evidences of hæmolysis in the liver, stomach, and intestinal capillaries were found in the eight cases. The hæmosiderin of the liver and kidneys is carried to these organs as some soluble derivative of hæmoglobin, is removed from the circulation as hæmosiderin by the endothelium, and then transferred to the liver- or kidney- cells. The deposit of iron in these organs is of the nature of an excretion. In the majority of cases only slight reaction for iron is found at the sites of actual hæmolysis (spleen, lymph- and hæmolymph- glands, and bone-marrow). The greater part of the pigment in the phagocytes of the spleen, lymph- and hæmolymph- glands does not give an iron reaction while in a diffuse form. When changed to a granular pigment the iron reaction may usually be obtained. The change to hæmosiderin is for the greater part accomplished by the endothelium of the liver and kidneys. The varying pathological conditions found in these different cases of pernicious anæmia can be explained only by a theory of cyclical or intermittent process of hæmolysis. This theory is also borne out by the exacerbations so frequently seen clinically. The autopsy findings, in so far as evidences of hæmolysis are concerned, will depend on the relation between the time of death and the stage of the hæmolysis. The changes in the hæmolymph-glands found constantly in these eight cases were: dilatation of the blood-sinuses and evidences of increased hæmolysis, as shown by the increased number of phagocytes containing disintegrating red cells and blood-pigment. In some of the cases these changes were accompanied by great increase in size and apparent increase in the number of hæmolymph-glands; in other cases there was no hyperplasia, the only evidence of the changes present

being that obtained by the microscopical examination. The changes found cannot be regarded as a specific of pernicious anæmia, since it is probable that they may be produced by other infections or toxic processes characterized by great hæmolysis. The lymphoid and megaloblastic changes in the bone-marrow do not form an essential part of the pathology of pernicious anæmia, and are to be regarded as of a compensatory nature: an increased activity of red-cell formation to supply the deficiency caused by the excessive hæmolysis. A. S. Warthin (Amer. Jour. Med. Sciences, Oct., 1902).

In cases in which the urine is dark the latter is found to contain pathological urobilin: a substance known to be derived from the disintegration of hæmoglobin.

Peculiarity of highly colored urine is that it presents a low specific gravity, averaging 1.014. Presence of pathological urobilin described by MacMunn of high diagnostic significance. W. Hunter (Brit. Med. Jour., July 5, '90).

Case in which the urine, instead of presenting the appearance upon which so much stress is justly laid by Hunter, was habitually pale. R. Douglas Powell (Clinical Journal, Aug., '96).

The gastric and intestinal disorders are probably due to the formation of a toxin, which, in turn, acts as the etiological factor of the general disease.

It is a question whether there can be any more satisfactory explanation of certain cases of surgical infection than this theory of the possible infection of wounds, not from outside, but from bacteria circulating in the tissues, which, under normal conditions, are destroyed and rendered harmless, but which under the abnormal traumatic conditions of the operation are now able to proliferate and set up local disturbances. The usual explanation of the abundant growth of bacteria in the various organs after death is that, while there may oftentimes occur an agonal invasion of bacteria, the essential cause of putrefaction is the entry of bacteria, more especially through the intestines after death. This explanation is based on the observation of large numbers of intestinal bacteria in the tissues about ten hours after death. The author believes this appearance of post-mortem invasion of the tissues is only apparent, not a real fact; it occurs because there is a preliminary period in which the bactericidal action of the tissues continues and the number of bacteria to be obtained from the tissues by ordinary methods is singularly small; following this there is multiplication. The existence of a condition of subinfection is considered probable. The writer has found minute diplococcoid bodies peculiarly frequent in the liver-cells in cases of hepatic cirrhosis. The frequency with which the colon bacillus has been found by other observers, associated with more acute hepatic disease, renders it not impossible that this bacillus may have some part to play in connection with the condition. A careful study of material from cases of hæmochromatosis with the highest power shows that when the pigment has not clumped together into too large masses in the liver-cells for example, or in the abdominal lymphatic glands, there are, in a very large proportion of the ultimate fine masses of pigment, distinct diplococcoid forms or bodies. In short, the condition of hæmochromatosis is of bacterial origin. Anderson, one of the writer's demonstrators, has made a special study of the bacteriology of the stomach in three cases of pernicious anæmia. He has found in all a complete absence of hydrochloric acid, with the presence, however, of considerable quantities of lactic and some butyric acid, and in all the cases he obtained by plating pure cultures of the colon bacillus, and, what is more, on making sections from one of the stomachs he found numerous diplococcoid forms in the submucous tissue. This was long before the nature of the pigment in the liver had been realized. In order to confirm the result, Ford made an independent examination in a case at the Royal Victoria Hospital, which absolutely confirmed the

findings of Anderson in every respect. J. George Adami (Jour. Amer. Med. Assoc., Dec. 23, '99).

Carious teeth are seen extremely commonly in this disease; inflammation of the mouth and tongue is also exceedingly common, as are gastric symptoms; the gastric catarrh is of an infectious nature and is dependent upon the caries of the teeth. The original infection may usually be traced to the teeth. Sometimes to drain poisons. Hunter (Lancet, Jan. 27, 1900).

Case of pernicious anæmia following on traumatic stricture of the small intestine. The necropsy confirmed the diagnosis of pernicious anæmia. The examination of the blood presented a typical picture of that disease. The patient had always had bad teeth, with alternate alveolar and ethmoidal suppuration, and chronic gastric catarrh, thus bearing out Hunter's idea as to pernicious anæmia being due to self-intoxication from the intestinal tract. A. E. Barker (Lancet, July 21 1900).

Eighteen cases of bothriocephalus latus anæmia and 3 of pernicious anæmia showed that, before removal of the worm, increased decomposition of albumin was present, while after removal of the parasite albuminous metabolism was not as greatly affected. Decomposition of albumin is probably due to some toxin produced by the worm. E. Rosenquist (Berliner klin. Woch., June 24, 1901).

Conclusions regarding the enterogenous origin of pernicious anæmia from experiments performed on metabolism are not tenable because we do not always know under what form of diet the disease occurs. Personal disposition must be taken into consideration. Many theories are exaggerated; the symptoms present in pernicious anæmia frequently exist without serious blood-changes being present. E. Grawitz (Berliner klin. Woch., June 17, 1901).

Repeated intravenous injections of living cultures of the colon bacillus into rabbits found to cause the development of a state of advanced anæmia, not quite comparable with any of the classical forms seen in man. In some respects it resembles pernicious anæmia, namely: in the very great diminution of erythrocytes, the marked poikilocytosis, and the appearance of nucleated red corpuscles. On the other hand, it differs from pernicious anæmia in the fall of the amount of hæmoglobin being parallel with the decrease of the red corpuscles, in the absence of a distinct and extensive Inincke's siderosis, in the absence of any clear evidence of inflammatory or other disturbances of the digestive tract, and of well-marked changes in the bone-marrow. In the advanced stage of this anæmia a diffuse degeneration of the spinal cord was set up, affecting the posterior and lateral columns of the cord, in the lumbar and dorsal regions. This degeneration consisted in a fatty degeneration of the myelin sheaths of the fibres and certain pigmentary changes in the nerve-cell bodies of the gray matter. The ventral columns of the cord and the gray matter were not affected. Similar conditions of anæmia and spinal-cord degeneration could not be produced by injecting killed cultures of the colon bacillus, nor by filtered cultures. When the living cultures were acted upon by pepsin, and injected intravenously, they did not differ materially in their action from the original living cultures. G. A. Charlton (Jour. of Med. Research, May, 1904).

The spleen is generally thought to present no characteristic lesion, although the amount of iron in it is usually increased.

Case in which there was, besides severe hæmolysis, sclerosis of the spleen and pancreas, with marked changes in the suprarenal capsules. Douglas Stanley (Brit. Med. Jour., Feb. 16, '95).

Case in which the total quantity of iron found in the liver was 0.2433 per cent. by weight calculated to the fresh undried tissue. This is equivalent to about 0.72 per cent. in the dried tissue. The estimation accords fully with the observations of previous observers, as showing the very great increase in the iron contained in the liver in this disease. R. F. Ruttan and J. G. Adami (Brit. Med. Jour., Dec. 12, '96).

In every spleen finely granular cells as myelocytes found. Eosinophilic myelocytes and normoblasts are only seen in spleens which have suffered alteration through congestion, infectious processes, and severe anæmias. Under certain conditions the spleen may undergo myeloid transformation, partly through the proliferation of the pre-existing myelocytes and partly through emigration to other cells, to which class belong the eosinophiles and normoblasts. Kurpjuweit (Deutsch. Archiv f. klin. Med., Bd. lxxx, p. 168, 1904).

The jaundice is probably due to accumulation of iron in the hepatic system.

Autopsy of a case. Iron reaction well marked in liver and kidneys, but absent in spleen; the amount of iron in the liver found by quantitive analysis to be five times greater than normal. T. N. Kelynack and F. J. H. Coutts (Medical Chronicle, Sept., '92).

Inquiry into the after-history of 22 cases. The disease believed to be due to an increase in the destructive action of the liver upon the red blood-corpuscles. While the 22 cases were thought to be "cured" by various means, 10 died of the disease, and only 2 were known to be living at the time of the investigation. H. C. Colman (Edinburgh Med. Jour., Mar. and Apr., 1901).

The posterior and lateral spinal tracts present changes resembling those observed in tabes.

Study of seventeen cases. The degree of nervous affection not necessarily proportionate to the degree of anæmia. In pernicious anæmia any of the spinal symptoms of tabes may be present, while symptoms entirely foreign to tabes may also occur. Diseased centres in any portion of white substance, preferably in posterior columns; gray substance, zone of Lissauer, and intermedullary roots remain unaffected. Nonne (Deutsche Zeitschrift für Nervenh., vol. v).

Microscopical appearances of brain in a case: hæmorrhages in the substance of the hemispheres; round, structureless bodies, resembling corpora amylacea, arranged in groups; fatty degeneration of the cells of the motor region; shrinkage and vacuolation of the cells of Purkinje. Biruli (St. Petersburger med. Woch., June 30, '94).

In nine cases localization of centres found to be the same as that given by others,—Nonne, for instance. A primary and possibly toxic affection of the nerve-fibres supposed. C. W. Burr (University Med. Mag., Apr., '95).

Changes in spinal cord similar to those met with in pernicious anæmia may occur in a variety of other diseases, combined with cachexia and marasmus, Addison's disease, diabetes, etc. W. Müller (Berichte der 24 deutscher Chirurgentag, '95).

Case with arteriosclerosis, paræsthesia, chronic enteritis, and increased knee-jerk. Small hæmorrhages found post-mortem in the corpora striata and corpora quadrigemina. Microscopical examination showed, besides changes described by others in the posterior columns, hæmorrhages in both the gray and white matter, with degeneration in the anterior and lateral columns of the cord. The change in the gray matter is of chief importance in this disease. Teichmüller (Deutsche Zeitsch. für Nervenheilkunde, B. 8, H. 5, 6, '96).

Study of nine cases: small hæmorrhages and consecutive sclerosis are frequently met with in the spinal marrow. These hæmorrhages have no significance from a clinical point of view. The vessels often show thickening and commencing hyaline degeneration (not, however, as a rule), combined with degeneration of the nervous elements. From a study of the literature it appears that comparatively few cases of pernicious anæmia present a real disease of the spinal cord. The symptoms of anæmia remain unchanged in cases in which it does occur, and it is difficult to explain why the cord should be affected in some cases and not in others. The disease of the cord manifests itself with somewhat varying symptoms, certain of which, however, are exhibited in all cases. From an anatomical point of view the alterations have considerable variations; but this is accounted for, to a great extent, by the fact that the process has been observed at a different stage in the

various cases. From a closer analysis of the cases it appears that the degeneration progresses in a fairly regular manner. It is presumable that these cases of disease of the spinal cord form a special group, even from a neurological point of view. It may be admitted that some toxic condition is the common, immediate cause of the disease of the spinal marrow as well as of the anæmia. The alterations of the spinal cord are here wholly different from those found in tuberculosis and diabetes, where the changes can easily be distinguished by slightly-marked and chronic degeneration, such as is often found in Addison's disease. Charles Petrén (Inaugural Dissertation, Stockholm; Universal Medical Journal, Feb., '96).

Evidence showing that extensive changes may be present in the cord in cases of pernicious anæmia without any marked clinical symptoms, and that the lesions are of somewhat diverse character. Whether the degenerations of systemic tracts depend on hæmorrhagic or myelitic foci in all cases there seems hardly yet sufficient evidence to show; the predominant affection of the posterior columns in the majority of cases, and their degeneration throughout the whole length of the cord on both sides, rather point to an independent affection of these tracts. J. Michell Clarke (Brit. Med. Jour., Aug. 7, '97).

In cases of pernicious anæmia the degenerative changes in the cord sometimes observed are not the result of mere anæmia, but are more probably the result of hitherto undiscovered chemical agents. A thorough examination of the metabolism in pernicious anæmia might, perhaps, throw further light on the question. G. von Voss (Deutsche Arch. f. klin. Med., vol. lviii, p. 489, '97).

Study of pathological lesions found in the spinal cord in cases of pernicious anæmia showed that there was usually a degeneration affecting the posterior columns, sometimes the posterior and lateral together, but never the lateral alone. This degeneration was chiefly in the nerve-fibres, and was unaccompanied by shrinking of the cord, such as was seen in locomotor ataxia. Seventeen cases analyzed in which initial nervous symptom was always a persistent paræsthesia, usually of the foot, associated with some weakness. This was generally followed quickly by ataxia and loss of motor power, and severe pains in the back and limbs were not uncommon. The disease progressed rather rapidly, so that often within one or two months the symptoms were well developed. In from six months to a year the progress commonly reached its acme, and during this time the anæmia became marked. After a time the control of the bladder and the rectum was lost and in fatal cases death occurred in from six months to two years. The essential nature of the process was a primary nerve-degeneration affecting the neuraxons first, particularly in the columns of Goll and the crossed pyramidal tract. The same poison which caused pernicious anæmia was responsible for this disease. It usually developed between the ages of 50 and 60 years, and followed the acute infections, prolonged diarrhœal or dysenteric attacks, lead poisoning, malarial infection, etc. In 10 per cent. or more of the cases pernicious anæmia undoubtedly co-existed. Charles L. Dana (N. Y. Med. Jour., Nov. 19, '98).

Examination of the spinal cord in cases of pernicious anæmia by the Marchi method. Results summarized as follows: (1) the changes in the spinal cord in fatal cases of anæmia are not systematic, but should be regarded as acute disseminated myelitis; (2) the foci exhibit a local association with the blood-vessels; (3) it is probable that a noxious material is carried to the cord by the blood-vessels, and this acts upon the nervous tissue; similar changes are found in old age; (4) even in advanced cases the gray matter may escape involvement; (5) if diseased, it is not primarily affected,—that is to say, it and the white matter are involved as the result of a single cause; (6) the diffuse character of the degeneration in these conditions justifies the conclusion that there is a trophic alteration, and not a functional injury of the nervous element; (7) the greater part of degenerated fibres are found in the posterior roots

and the anterior commissure. Nonne (Deut. Zeits. f. Nervenheilk., Mar. 9, '99).

Case of combined sclerosis of Lichtheim-Putnam-Dana type accompanying pernicious anæmia. The condition thought to be a primary systemic degeneration dependent upon the pernicious anæmia. Brown, Langdon, and Wolfstein (Jour. Amer. Med. Assoc., Mar. 2, 1901).

There is a well-established relation of diffuse cord degeneration with pernicious anæmia. In seems highly probable that the hæmolysis and the cord-changes are due to the same toxin. While the source of the toxin is unknown, the fact that gastro-intestinal disturbance is so common in the disease would lead one to suppose that it is of intestinal origin. The diffuse degenerations of the spinal cord which occur in conditions without pernicious anæmia do not appear to differ essentially from those of pernicious anæmia. It is possible that a common blood-circulating poison exists, which may expend its force upon the blood in one individual, upon the nervous apparatus in another, and coincidently upon the blood and spinal cord in others. Frank Billings (Boston Med. and Surg. Jour., Aug. 28 and Sept. 4, 1902).

The bone-marrow usually presents changes. Those most frequently found, according to Muir, are (*a*) increased number of nucleated red corpuscles in the marrow; (*b*) transformation of the fatty marrow in the shafts of the long bones into red marrow; (*c*) absorption of the bone-trabeculæ between the red marrow.

Bone-marrow of a case composed mainly of hæmatoblasts. Normally, the formation of red corpuscles is probably due to the constricting off, from the nucleus, of the hæmatoblast of protoplasm, colored with hæmoglobin. In pernicious anæmia this process does not take place. Rindfleisch (Virchow's Archiv für pathologische Anatomie, B. 121, p. 176, '91).

Autopsy showing that the marrow had returned to the fœtal condition. A. Pineau (La France Méd., Mar. 11, '92).

From the point of view of the function of the bone-marrow, three types of pernicious anæmia may be made: (1) cases without any reaction on the part of the bone-marrow; (2) those in which the reaction is insufficient; (3) those in which there is a degeneration of the bone-marrow, on account of which it furnishes almost exclusively disintegrating megaloblasts. The condition of the blood is not always an evidence of the changes taking place in the bone-marrow. The percolation of the bone-marrow seems not to occur in a uniform manner, that it does not seem to affect all the elements in the same way. Neusser (Wiener klin. Woch., Apr. 13, '99).

Five cases of grave anæmia in which the bone-marrow apparently had lost its power of forming red corpuscles at a comparatively early period, as the examination of the blood showed no nucleated or polychromatophilic red corpuscles. An absence of nucleated red corpuscles in the blood in cases of grave anæmia indicates that there is no new formation of red corpuscles taking place. The prognosis for such cases is extremely bad. When the number of red corpuscles is above 1,500,000 per cubic millimetre, the presence or absence of nucleated red corpuscles is of little significance; but, when they are below that number and nucleated red corpuscles are absent, a fatal result may be confidently predicted. J. S. Billings (N. Y. Med Jour., May 20, '99).

The albuminoid constituent of the organism may be at fault.

Fatal case in which examination of the blood-serum showed that the proteids of the plasma were altered in their respective proportions. Adami (Montreal Med. Jour., Aug., '93).

Analysis of the blood-serum removed from the right heart: it was clear, almost colorless, had a specific gravity of 1026.1. This is below the figure usually given as being that of the specific gravity of serum, namely: 1027 to 1030. It con-

tained only 5.2 per cent. of proteids (by weight). These proteids consisted of 2.3 per cent. of globulins precipitated by saturation with magnesium sulphate, and 2.9 per cent. of serum-albumin proper. There was 0.875 per cent. of ash. It will thus be seen that not only were the total proteids reduced about 40 per cent. below the average normal quantity, but also that the normal ratio of the globulins to the serum-albumin was considerably altered; the ash, also, was about 12 ½ per cent. above the normal. R. F. Ruttan and J. G. Adami (Brit. Med. Jour., Dec. 12, '96).

As ill understood as the etiology of the disease is the actual condition of the blood. The microscopical appearances are well known, but the true chemical changes have almost entirely been neglected. The blood in pernicious anæmia contains a larger quantity of water than normal blood, a smaller quantity of solids, a higher proportion of chlorine, and a lower proportion of potassium, iron, and fat. There is not sufficient sodium to hold the chlorine fixed, and the potassium is also deficient. In various tissues the proportion of water was higher than normal in the heart, and lower in the liver, spleen, and brain. Treatment of pernicious anæmia with potassium carbonate, tartrate, and citrate, in four cases, three of which were dying, resulted in recovery. Th. Rumpf (Berliner klin. Woch., May 6, 1901).

The disease may be due to some hitherto undiscovered organism.

Two cases in which 5-milligramme injections of sublimate daily for the space of two months were followed by rapid improvement. Patera (Riforma Medica, May 23, '96).

The causes of the disease are of a complex nature. Some cases present no appreciable lesions.

Case in which death occurred from gradual asthenia. Entire absence of organic disease in all the organs examined; blood-count gave 1,600,000 red corpuscles per cubic millimetre (32 per cent.), while hæmoglobin amounted to 16 per cent. J. H. Musser (University Med. Magazine, July, '93).

[A disproportion of this kind is certainly unusual in pernicious anæmia. F. P. Henry, Assoc. Ed., Annual, '94.]

A high degree of anæmia usually follows numerous predisposing causes. In some it tends to cause degenerative changes in vessels, leading, in turn, to capillary hæmorrhages, conferring pernicious character. R. Stockman (Brit. Med. Jour., May 4, '95).

[I have for many years maintained that the arguments in favor of the "idiopathic" nature of pernicious anæmia are very faulty. F. P. Henry, Assoc. Ed., Annual, '96.]

Prognosis.—The mortality, from very nearly 100 per cent., has been greatly reduced since the introduction, by Byrom Bramwell, of Edinburgh, of arsenic. A guarded prognosis should always be given, however, relapses being exceedingly common. About one-half of the fatal cases last from one to six months; the remaining seldom reach beyond the second year.

In attempting to reach a decision as to the efficacy of any plan pursued in the treatment of pernicious anæmia, it is to be borne in mind that periods of transitory improvement, of varying duration, are often a part of the natural course of the disease; so that too much importance must not be attached to the favorable results that may follow the special line of medication employed. Even if such improvement continue for a long time, the conclusion must not be too hastily reached that the disease is cured. Editorial (Med. Record, Nov. 14, '96).

Treatment. — Arsenic cures the curable cases and benefits the others. Iron is worse than useless, having shown itself injurious in several cases reported. Fowler's solution may be given in 3-minim doses three times a day, increased

by 1 minim daily until 30 minims are taken after each meal, provided the stomach does not rebel, which is seldom the case. The patient should be watched and the drug reduced or discontinued temporarily on the appearance of any of the physiological effects of arsenic: œdema of the lids, etc.

Arsenic is as much of a specific in pernicious anæmia as mercury is in syphilis. Warfvinge (Transactions of the Eleventh International Medical Congress, '94).

Iron produces no permanent benefit.

Acid preparations of phosphorus exert a temporary tonic effect.

Intestinal antiseptics, advocated by Hunter, only of use in cases complicated by gastro-enteric fermentations.

Alcohol (that is, distilled liquors) does no good; malt liquors—ale or beer—if borne well, retard progress of disease.

Arsenic, when tolerated in heroic doses, is very beneficial, but no permanent cures have been authenticated. I. N. Danforth (Boston Med. and Surg. Jour., June 25, '96).

Case, which came under observation in 1892, of a man whose blood showed only 1,600,000 red corpuscles to the cubic millimetre. Under arsenic the red corpuscles rose to 4,000,000 and the man was practically well. In 1893 he relapsed, and on ascending doses of Fowler's solution he improved and went back to work as roller in a rolling-mill. In the following year he returned to the hospital in a worse condition than previously. Again, on arsenic he improved. Now, two years later, he is large and portly, weighing 250 pounds. His hæmoglobin is 90 per cent. and blood-corpuscles 4,800,000. M. H. Fussell (Boston Med. and Surg. Jour., June 25, '96).

Marked case (mentioned under PATHOLOGY) in which large doses of arsenic (for several days the patient took no less than from 50 to 60 minims of Fowler's solution in the twenty-four hours) caused remarkably rapid recovery. The condition of the blood improved and the jaundice removed along with other symptoms.

Table Showing the Condition of the Blood and Dose of Arsenic at Different Dates.

Date.	Number of Red Blood-corpuscles per Cubic Millimetre.	Percentage of Hæmoglobin.	Number of White Blood-corpuscles per Cubic Millimetre.	Dose of Liquor Arsenicalis per Diem.
May 5th	810,000	20	.....	20 minims.
May 10th	970,000	28	13,000	40 minims.
May 16th	1,710,000	40	12,000	50 minims.
May 20th	.....	...	.....	60 minims.
May 23d	2,650,000	42	.....	40 minims.
May 26th	2,950,000	46	.....	40 minims.
June 8th	2,700,000	64	.....	40 minims.
June 14th	3,420,000	64	12,000	40 minims.
July 20th	4,010,000	88	14,000	

Byrom Bramwell (Lancet, July 24, '97).

At least two years should elapse before a patient is reported cured. Patient who has been cured of pernicious anæmia for the space of two years by the use of arsenic pushed to the point of tolerance. The gentleman now an active businessman. F. P. Henry (Boston Med. and Surg. Jour., June 25, '96).

There is no specific remedy for pernicious anæmia. Rest in bed is one of the first requisites, the assimilation of food must be stimulated. Lavage of the stomach, intestinal irrigation, and saline laxatives are useful. In rare cases with diarrhœa, calomel may first be given; later astringents, such as tannin. If the urine contain much indican intestinal antiseptics are indicated. Iron is of no value, and in the beginning is contra-indicated. Arsenic is the best remedy; can be given with quinine. Inhalations of oxygen have been employed with advantage. Massage and gymnastic exercises are often of service. After apparent recovery the patient must be carefully observed, as relapses are likely to occur, particularly if the hygienic and dietetic conditions are unfavorable. E. Grawitz (Berliner klin. Woch., Aug. 15, '98).

When the gastric disorder, which is a usual symptom, prevents the administration of arsenic, the latter may be given subcutaneously, while the stomach is treated directly by lavage.

An excess of hydrochloric acid is not uncommonly found in the gastric secretions. In such cases Sée recommends an almost exclusive diet of meat and

other albuminous foods: raw meat to the extent of 10 to 12 ounces daily.

Bone-marrow sometimes proves curative.

Case successfully treated with bone-marrow, uncooked, 3 ounces daily. In a case in which the prolonged administration of iron and arsenic in both medium and large doses was proved useless. Thomas R. Fraser (Brit. Med. Jour., June 2, '94).

The plain marrow cannot always be administered on account of the objection of the patients. The red marrow from the tibia of the calf, mixed with an equal quantity of glycerin and rubbed up in a mortar, results in a preparation of pleasant taste and one that can be eaten with bread without disturbing the stomach. The preparation may be made more fluid by the addition of claret or port wine. Alfred Stengel (Therapeutic Gazette, No. 13, '96).

Severe case of pernicious anæmia, complicated with œdema, ascites, and cardiac symptoms; 2 ¾-ounce doses of fresh bone-marrow administered daily in soup or on bread. The patient was cured in two and a half months. Blumenau (Pediatrics, June 15, '97).

(See also ANIMAL EXTRACTS.)

In pernicious anæmia bone-marrow is not by any means of constant value. Such cases with large doses of iron and arsenic do very often improve. But herein lies the difference clinically between simple and malignant anæmia: in the former complete cure results, but with tendency to relapse, when the case is appropriately treated. In the latter, at the best some improvement occurs. The amount of hæmoglobin increases, but does not attain the normal, and in no long time the patient is as bad as ever. T. G. Stewart (Clinical Journal, Sept. 14, '98).

Transfusion of blood should be resorted to when improvement does not follow the administration of arsenic.

Transfusion of blood recommended. Blood a very indigestible substance. The practice of drinking it at slaughter-houses is not to be commended. Laache (Wiener klin. Woch., Sept. 18, '89).

Case treated successfully by transfusion of blood defibrinated and mingled with a 2-per-cent. solution of phosphate of sodium in the proportion of 5 ½ ounces of the former to 3 ounces of the latter. W. G. Evans (London Lancet, May 13, '94).

[Transfusion should never be omitted if improvement does not follow the free use of arsenic. The best method is that employed by Brakenridge, of Edinburgh (Edinburgh Med. Journal, Oct., '92). The blood is kept fluid by admixture with one-third part of its bulk of a 1-to-20 (5 per cent.) solution of phosphate of soda in distilled water kept at blood-heat. John Duncan, who performed the transfusions in Brakenridge's cases, insists upon the necessity of slowness in operating. He regards thirty minutes as the minimum time that should be occupied in injecting 8 ounces of the fluid.—F. P. HENRY, Assoc. Ed., Annual, '94.]

Defibrinated blood has been used subcutaneously by Westphalen, with success.

Subcutaneous injections of normal saline solution may replace transfusion.

Case of a man, aged 55 years, in whom blood-count showed 480,000 per cubic millimetre; hæmoglobin, 20 per cent. There was delirium, vomiting, and diarrhœa. Treatment by subcutaneous injections of normal, saline solution on every alternate day, and the intervening by saline enemata, with arsenic internally. Patient practically well. Alexander McPhedran (Canadian Pract., Nov., '97).

Protonuclein seems to possess curative properties.

Marked case in which protonuclein was used as a last resort. A 3-grain tablet ordered to be taken every three hours and all other remedies suspended. Two days later kidneys were acting more freely, but patient's condition otherwise unchanged. The tablets then given every two hours. Three days later very decided improvement. The kidneys were acting freely, skin moist, œdema passing away, and a decided gain in general.

Improvement continued several weeks, after which the treatment was altered, the tablets being taken every three hours, together with $^1/_{20}$ grain arsenous acid thrice daily. Recovery. R. P. Beggs (Amer. Medico-Surg. Bull., Dec. 19, '96).

Intestinal antiseptics have been recommended.

The best intestinal antiseptic is betanaphthol and salol, along with arsenic when that can be borne. William Hunter (Brit. Med. Jour., Apr., '94).

[I would take exception to Hunter's statement that salol is an intestinal antiseptic. "An intestinal antiseptic," according to Bouchard,—and there is no better authority,—"must be more or less insoluble and exert no toxic action on the organism. This definition excludes salol, which no sooner comes in contact with the alkaline secretions of the intestine than it splits into carbolic and salicylic acids, both of which are rapidly absorbed."

The best intestinal antiseptic is undoubtedly thymol: a fact which seems to be more fully appreciated in Italy than elsewhere. In accordance with the view that pernicious anæmia is due to the absorption from the intestine of substances foreign to the healthy body, and destructive to the red corpuscles, its treatment by intestinal antiseptics is certainly most rational. F. P. Henry, Assoc. Ed., Annual, '95.]

When the disease is due to the anchylostoma duodenale, thymol, 2 to 3 drachms daily, is a very effective vermicide, according to Bozzolo.

Serum-therapy seems to merit further trial.

Antistreptococcic serum used with gratifying results in two cases of anæmia: one pernicious, the other simple. In the former, examination of the blood showed 4000 white and less than 1,000,000 red corpuscles to the cubic centimetre, and 30 per cent. of hæmoglobin. Eight injections of 8 cubic centimetres each were given at intervals of two or three days. After the third, improvement began and progressed steadily. Three days after the last injection the blood contained 5000 white and 4,960,000 red corpuscles, and 90 per cent. of hæmoglobin. W. H. de Witt (Cin. Lancet-Clinic, lxxxiv, p. 61, 1900).

Case of a man, 37 years of age, whose symptoms, on coming under observation, were: (1) weakness and extreme anæmia—the red corpuscles were 27 per cent. and hæmoglobin 35 per cent., with poikilocytosis; (2) a lemon color of the skin with urobilinuria; (3) a sore tongue, dental necrosis, suppuration of the gums, and gastric pains; (4) tingling and numbness of the fingers and irregular pyrexia.

The treatment consisted of oral and gastric antisepsis. During July three injections of antistreptococcic serum were given. After the first the red corpuscles rose to 36 per cent.; after the second to 52 per cent.; and in three weeks the red corpuscles rose to 65 per cent. and the hæmoglobin to 72 per cent. In September arsenic was added to the other treatment, and by December the red corpuscles had risen to 94 per cent. and the hæmoglobin to 100 per cent. William Hunter (Lancet, Mar. 30, 1901).

Hydrotherapy applied in the form of high enemata of normal salt solution, repeated two or three times in the twenty-four hours, is of service. This treatment is based on the theory that the disease is of probable toxic origin, with the seat primarily in the intestines. Frank Billings ("System of Physiological Therapeutics"; Phila. Med. Jour., Feb. 14, 1903).

Frederick P. Henry,
Philadelphia.

ANÆSTHESIA. See individual anæsthetics.

ANALGEN. — Analgen is a derivative of quinoline and occurs as a white crystalline powder readily soluble in hot alcohol, slightly so in cold alcohol, but insoluble in water. It is tasteless.

Dose.—The dose is from 4 to 10 grains, repeated every three hours if necessary.

Maximum single dose 15 1/2 grains and the maximum daily dose 1 drachm. Schreiber (Amer. Medico-Surg. Bull., Jan. 25, '95).

Although of no pathological significance, the fact that analgen causes a red discoloration of the urine sometimes frightens the patient, and he should be informed of this phenomenon.

Physiological Action.—Analgen seems to act upon the sensitive centres, lowering their excitability. The separation products of the drug are frequently eliminated by the urine, which is of a red color, rendered more marked by the addition of acetic acid,—1 to 10 (Dujardin-Beaumetz and Dubief). Bicarbonate of soda, given internally, is said to prevent this discoloration.

Therapeutics.—Analgen is mainly used in the treatment of conditions in which pain is a prominent feature.

Neuralgia.—In this disorder it often proves very efficient.

Used in about two hundred cases, the majority neuralgia. The full dose of 15 grains necessary to produce relief. Foy (Med. Press and Circular, June 13, '94).

Febrile Conditions.—In the various disorders presenting fever as a prominent symptom, whether due to malaria, infectious processes, or to the undue presence in the blood of products of elimination, it has been credited with considerable merit.

Analgen is valuable as an antipyretic and germicide. One and one-fourth to 1 1/2 drachms daily cause fall of temperature of from 3 /2° to 5° F., within half an hour after the first dose of 15 to 30 grains, continuing for three days, often accompanied by profuse perspiration. Phthisical patients experience a peculiar feeling of well-being from its use. In doses of 3/4 to 1 drachm it acts remarkably on muscular or acute articular rheumatism. It does not, however, prevent relapses or complications. Maas (Zeit. f. klin. Med., B. 28, H. 1, 2, '95).

Used exclusively in 59 cases of children, ages of the patients ranging from 20 days to 13 years, 33 being various manifestations of malarial poisoning. The dosage varies from 3 1/2 grains to 45 grains in twenty-four hours. No unfavorable action upon the respiration or circulation. Urine deep yellow or red, albumin or sugar never present. Action prompt and efficient, reducing temperature and shortening the period of the disease. Moncorvo (Bull. de l'Acad. de Méd. de Paris, Nov. 10, '96).

ANALGESINE. See Antipyrine.

ANCHYLOSTOMUM. See Parasites, Intestinal.

ANESIN.—Anesin is a trichlorpseudobutyl-alcohol, or acetone chloroform, a 1-per-cent. solution of which is said to possess the anæsthetic power of a 2 1/2 solution of cocaine hydrochlorate. It is also reported by Vámossy as capable of standing unimpaired as a solution for a long time. It is said to be sterile and non-poisonous and to produce no local irritation.

Dose.—The 2-per-cent. solution is used as a local anæsthetic in the same manner as cocaine. It may also be injected subcutaneously.

Physiological Action.—When applied to the tongue, anesin first gives rise to a sensation suggesting the presence on the organ of a foreign body. This soon disappears, and is replaced by local anæsthesia. It acts in the same manner when injected subcutaneously.

Therapeutics.—Anesin has so far been tried as an anæsthetic in diseases of the eye and throat and in minor surgery. It is also credited with hypnotic properties by Kossa.

Ophthalmology. — Its main use has been as a local anæsthetic in ophthalmology. Grósz has recommended it,

owing to the fact that it does not cause mydriasis. In important operations, however, he prefers cocaine. Anesin only anæsthetizes the spot to which it is applied, its power of diffusion being small. It does not produce anæsthesia of the iris.

Laryngology.—Anesin was found by Israï to cause prompt local anæsthesia of the nasal mucous membrane of the pharynx and larynx without giving rise to untoward symptoms. It does not, however, produce, even in strong solutions, the profound anæsthesia resulting from the use of equally strong solutions of cocaine.

Minor Surgery. — Antal has tried anesin in dental operations and found it very useful. Hüld found it equally valuable in all kinds of operations, and emphasizes the fact that its harmlessness should insure its preference over cocaine in all minor operative procedures.

Anesin in a 2-per-cent. solution gives rise to no local irritation or general poisoning. It is an effective anæsthetic. V. Vámossy (Deutsche med. Woch., Sept. 2, '97).

ANEURISM. — From Greek, ἀνά, through, and ἐυρύνω, I widen.

Definition.—A tumor containing blood or formed by a localized dilatation of a blood-vessel, communicating with the interior of that vessel. It may involve an artery or a vein, or both conjointly.

Arterial Varieties.—As to cause, arterial aneurisms may be divided into two classes:—

Idiopathic, or *spontaneous,* in which the aneurism is due to disease of the arterial walls.

Traumatic, in which it is due to an injury of a perfectly healthy vessel.

Idiopathic Aneurisms. — These are subdivided into three varieties:—

1. *Tubulated,* or *fusiform,* in which the three coats of the artery are dilated simultaneously. The dilatation affecting the circumference as well as the length of the vessel, it presents the appearance of a circular enlargement rather than that of a tumor. It is usually observed in the cranial, thoracic, and abdominal cavities, and is generally smaller than the other varieties of aneurism.

2. *Sacculated,* in which the aneurism projects from the side of the artery or from that of a tubular aneurism. These are usually divided into *true* aneurisms, in which all the coats of the artery are dilated, and *false* aneurisms, in which but two coats of the artery remain: the internal and the outer. The former do not attain great size, while the latter may assume enormous proportions.

[The distinction made between true aneurisms, where all the coats of the artery are dilated, and false aneurisms (traumatic aneurisms), where the walls do not consist of all three arterial coats, is artificial and incorrect, according to Cohnheim. J. McFadden Gaston.]

A false, sacculated aneurism may be *circumscribed,* the sac in that case remaining whole, or *diffuse,* the sac having ruptured, allowing the blood to become diffused into the surrounding tissues, where it may become imprisoned by an artificial cavity formed by the neighboring cellular tissue.

3. *Dissecting,* in which an early rupture of an atheromatous abscess in the arterial wall has enabled the blood to dissect its way between the internal and external coats until, sooner or later, it makes an issue for itself into the interior of the vessel or exteriorly. In the former case it assumes the shape of a sessile growth. This form occurs especially in the aorta, where it may suggest the presence of a double aorta, and in the smaller cerebral arteries.

Symptoms. — The patients are sometimes made conscious of the formation of an aneurism by feeling something give way, or a sudden, sharp pain, or, in orbital aneurism, hearing a sound like a percussion-cap.

The subsequent symptoms vary according to the stage of development at the time the case is examined.

During the first stage—*i.e.*, the period intervening between the onset and the time when the sac has become firm—pulsation of the tumor is clearly felt at each beat of the heart. If both hands are placed over it, the expansion of the growth will tend to separate them. When it is possible to apply pressure on the artery above the tumor, its size is diminished, while, if applied below, the contrary is the case. The reason for this is obvious: when the pressure is applied above the aneurism the flow of blood into the cavity is interfered with, while the blood-pressure is increased within the cavity when pressure is exerted below. This method of examination, however, is not altogether safe.

The pulsations of the heart above the seat of the aneurism are weaker and slightly retarded. Sphygmographic tracings are also modified from the normal type.

Auscultation will reveal a blowing or rasping bruit not only in the aneurism, but also in its artery, extending some distance beyond the sac. This bruit is not present in every case. It is also heard in malignant vascular tumors, but it is strictly localized to the growth, being never transmitted along the artery.

The second stage begins when the aneurismal sac has become firm and resisting, on account of the deposit of laminated fibrin within it. In some cases no fibrinous deposit is formed, so that no second stage can properly be taken as a guide.

The pulsation becomes more indistinct, or even altogether lost, on account of the thickening of the aneurismal wall and the deposit of fibrin. If the layer of fibrin is not of the same thickness everywhere, the pulsation may be more distinct at some points over the sac.

Pressure over the sac causes cessation of the pulsation, but the aneurismal tumor will not vanish, on account of the fibrin deposited within it.

A *bruit* will generally be heard over the sac and along the artery, but, like the pulsation, will be detected with varying distinctness according to the portion of the sac examined.

Pain may be an early symptom of aneurism; it is more commonly found in the second stage, when it may be sharp and lancinating or resemble the aching or boring of ulceration. It is due to the pressure produced by the tumor on the nerves, and is consequently intense in popliteal aneurism along the course of the popliteal nerve, which is, at times, flattened out upon the tumor.

> Case in which there was no pain: a very constant symptom in thoracic aneurism. Nevertheless, the face flushed when the head was lowered, there was tracheal tugging; no fremitus could be felt over the left side of the chest; there was no pulsation in the left carotid, and the radial pulse on the left side was small. The loss of fremitus is one of the earliest signs of aneurismal pressure. Glynn (Brit. Med. Jour., Feb. 6, '97).

If located in one of the extremities, œdema of the limb constantly occurs after the aneurism has reached a certain size. It is due to pressure upon the veins, and may not only be painful, but also terminate in ulceration and sloughing.

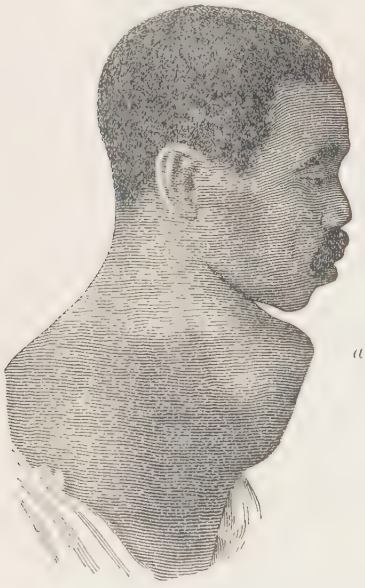
Gangrene is a late symptom and may

suddenly be caused by an embolus. Usually it is due to excessive œdema.

An aneurism may press upon various organs. If bone is compressed the pain is boring and gnawing, and results in the absorption of the osseous tissue.

Glands may, through this cause, cease their functions.

Compression of the trachea causes difficulty in respiration; of the œsophagus, trouble in swallowing. If the thoracic



Aneurism of the ascending, transverse, and upper portions of the descending aorta. *a*, Point of rupture. (*A. A. Smith.*)

duct is interfered with, nutrition is impaired.

A peculiar brassy cough is produced by compression of the recurrent laryngeal nerve. Hiccough is frequently a result of pressure on the phrenic nerve, while marked capillary congestion may be caused by pressure on the sympathetic nerve.

Intracranial aneurism may give rise to hemiplegia, facial paralysis, deafness, ptosis, blindness, or strabismus, caused by pressure on various nerves.

> Case of aneurism of the middle cerebral artery in a male 65 years of age. The attack had begun with a very marked vertigo. Soon after he was discovered he became speechless. Breathing was very slow and irregular, and face was flushed. Both pupils were contracted, the right one slightly more than the left. Paralysis of the left side, which gradually increased and extended to the left leg. Death on the second day. On autopsy, very decided hardness of the middle cerebral artery found, and an aneurismal sac dissected out, which measured one centimetre in length and one-half centimetre in diameter, and was ovoid in shape. On first examination it had closely resembled an ordinary cerebral hæmorrhage. T. M. Prudden (Med. Record, Nov. 13, '97).

Differential Diagnosis.

Abscess. — Although in abscess the pulsation is distinct, it is not expansile. If the artery above the abscess be compressed, pulsation will be felt as soon as pressure is removed, and not, as in aneurism, only after the aneurismal sac has been filled.

> A case of aneurism of the femoral artery in a child which simulated, to a certain extent, an abscess resulting from coxalgia. Differential diagnosis was made on the presence of expansile pulsation, a well-marked thrill and bruit, and the presence of heart disease. Sac was opened and cleared of clot. Johnson (Quart. Med. Jour., Oct., '98).

Pulsating Tumors. — Vascular sarcoma, pulsating encephaloid, hæmatocele, and erectile tumors in general are, as a rule, not expansile. This differential sign is especially valuable when a tumor overlies an artery.

Rheumatism.—The pain of aneurism sometimes suggests rheumatism at its onset, especially when the aneurism is popliteal.

NEURALGIA. — Pain is strictly localized, and none of the symptoms denoting an expansile growth are present.

ARTERIAL PULSATION. — Localized,

Thoracic aneurism. Examination with fluoroscope: The curved line in the upper part of patient's left chest and the curved line on his right chest indicate the outline of the aneurism as seen in the fluoroscope. The lower curved line on the left chest marks the outline of the heart; the lowest curve on the right front, part of the outline of the diaphragm; the dotted line, the cardiac area as determined by percussion. This case shows how a large aneurism may exist in the chest without giving rise to marked physical signs. (*F. H. Williams, Amer. Jour. Med. Sci., Dec.*, '97.)

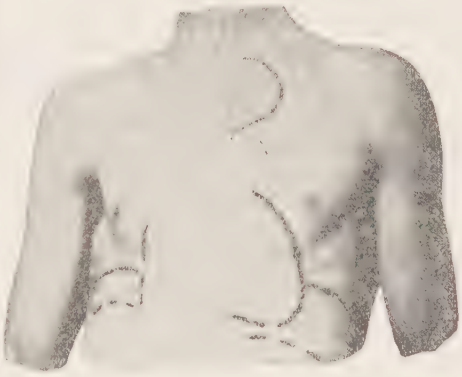
but not persistent, pulsations of arteries may simulate aneurisms, and have been described by Paget and West under the names of *mimic* or *phantom aneurisms*.

HÆMOTHORAX AND EMPYEMA.—These complications of pleuro-pulmonary diseases may be simulated when an aortic aneurism has ruptured.

Value of x-rays in the diagnosis of thoracic aneurism in which the outlines of the aortic swelling are clearly shown. In one case (possibly of tuberculous adenitis), in which the symptoms suggested an aneurism, the sciagraph showed no enlargement of the aorta. The arrest of the x-rays by an aneurismal tumor is due to the blood and probably to the iron contained in it. Tuberculous deposits are thought to be impervious to the rays, but this is still a matter of some uncertainty. In the cases in which aneurism existed, the diagnosis had already been made, but the picture made by Roentgen rays confirmed this diagnosis. William Pepper (Med. Record, Nov. 28, '96).

Aneurisms of the thoracic aorta can sometimes be detected earlier by x-ray examination than in any other way. In obscure cases, where an aneurism of certain portions of the aorta is suspected, but does not exist, it may be excluded by an x-ray examination. (See woodcuts.) Francis H. Williams (Amer. Jour. Med. Sciences, Dec., '97).

As aneurisms of the valves are chiefly dependent on endocarditis and atheroma, the symptoms are those of these diseases, and they have no separate symptoma-



These two figures show a smaller aneurism of the aorta. The arrow on the dorsal side points to where the pulsation was best seen. (*F. H. Williams, Amer. Jour. Med. Sci., Dec.*, '97.)

tology; yet the auscultatory phenomena may have diagnostic significance. Aneurism of the mitral may produce a rudimentary murmur immediately following the systole. Frequently in perforated aneurisms the sounds are most peculiar: humming, blowing, groaning, hissing, singing, whistling, scratching, piping, or musical. A musical murmur, especially in the aorta, which was not present in an apparently-healthy individual the day previously, may be looked upon as dependent on valvular aneurism. Musical murmurs due to aneurisms may disappear for days and then return. They may vary in time, place, and quality. They can only be properly interpreted when taken in connection with other physical signs yielded by the heart. Drasche (Wiener klin. Woch., Nov. 10, '98).

Diagnosis between aneurism and mediastinal tumors based upon 150 cases of aneurism, 200 cases of stenosis of the œsophagus, and a large number of other cases of mediastinal tumor. The most important signs of mediastinal disease are stenosis and pressure-paralyses of the recurring nerve. Tracheal stenosis is the most important of the various forms of stenosis, and if it is present the probability of the presence of aneurism is very great. Permanent signs of stenosis of the œsophagus constitute almost secure evidence of mediastinal disease, and exclude aortic aneurism. Hampeln (Zeits. f. klin. Med., B. xlii, H. 3 and 4, 1901).

Five cases in which the Roentgen rays proved of value in the diagnosis of thoracic aneurism. A transverse position of the heart is an important sign. Walsham (Edinburgh Med. Jour., Apr., 1901).

Etiology. — Age is an important factor, aneurisms being observed especially in adults in their prime: *i.e.*, between thirty and forty years of age. This is due to the fact that men are still engaged in vigorous occupations at that age, neither the heart nor the muscles having lost their strength, while it is then that arteries begin to show symptoms of degeneration. In very young people aneurisms are exceedingly uncommon.

As to sex, females, owing to their less active life, are but little affected with aneurism, the proportion being one to seven, as compared to males.

Spontaneous aneurism is usually due to degeneration of the artery-wall caused by atheroma or adipose infiltration. As a result, the artery is unable to contract during the cardiac diastole, and its diminished resistance to the pressure of the blood caused the vascular walls to gradually dilate. As atheroma presents itself chiefly during middle life, while physical use of the system is still violent, this class of aneurism is most frequently met with in people between thirty and forty years of age. Inflammatory changes are also considered as a prolific cause.

Aneurism is solely a consequence of alterations of the arterial walls, particularly arteritis. Alcoholism accounts for great frequency of this affection in certain countries. Localization in arterial coats depends upon the more or less advanced degree of sclerosis or atheroma. Duplaix (Des Anévrysmes et de leur Traitement, '95).

The old theory that degeneration of the wall of the artery always precedes aneurism of any vessel is the true one. Loss of vascular tone can scarcely be accepted as a sufficient cause. A. McPhedran (Can. Pract., Aug., '98).

Aneurism of the abdominal aorta noted in a boy, 9 years of age, who had been repeatedly the subject of rheumatism. There was also atheroma of the aorta, and in two places there were beginning aneurisms of the arch. The aneurism of the abdominal aorta was as large as a golf-ball. It was at the division of the common iliac arteries. R. K. Aitken (Brit. Med. Jour., June 25, '98).

Syphilis is a common etiological factor.

Importance of syphilitic arteriosclerosis in the production of aneurisms insisted upon. Of twenty-eight cases syph-

ilis found to exist in twelve. Heiberg (La Semaine Médicale, July 27, '92).

Of nineteen patients 47 per cent. had had syphilis, all under fifty years of age. This illustrates the relation of precocious arteriosclerosis and syphilis. Fraenkel (Med. Record, N. Y., Nov. 17, '94).

Among European residents of Japan aneurisms of the abdominal and thoracic aorta are very frequent; syphilis is very common. Eldridge (N. Y. Med. Jour., Feb. 10, '94).

Syphilis found to be a possible cause in one hundred and sixty-six cases out of two hundred and forty. In twenty-eight of the one hundred and sixty-six cases syphilitic lesions were present. The greatest frequency of aneurisms occurs between five and ten years after syphilitic infection.

In the great majority of cases aneurisms due to syphilis cannot be distinguished from aneurisms due to other causes, nor are any special pathological lesions present. Differentiation by treatment is not reliable. Etienne (Ann. de Dermatologie, vol. viii, p. 1, '97).

The term "dissecting aneurism" has been applied to a form in which, the inner walls of the aorta or one of the large arteries having ruptured, the outer coats remain intact, the blood dissecting a passage between the layers of the middle coat. There are altogether about two hundred cases of this condition recorded, and in by far the larger number of these death evidently occurred either immediately or within a few hours, most frequently by the blood forcing its way into the ascending aorta and thence into the pericardial sac. Only in a small percentage of the cases was compensation established and the dissecting channel repaired either by the development of secondary openings into the vessel or by the organization of the blood, which, after escaping between the walls, became clotted. There are singularly few cases on record of this last mode of repair; it is more common to find that, where death is not the direct result of the condition, the dissecting channel gains an endothelium, a channel being formed, opening above and below into the aorta or one of the larger arteries, and resembling the primitive vessel so closely that it is not to be wondered at that some of the earlier cases of the condition were described as congenital abnormalities. (Adami.)

Dissecting aneurisms may be due, in the old, to atheromatous change; in the young to congenital malformation of the central organs of the circulation; sometimes, also, to traumatism. Hypertrophy of the heart, especially in its left half, is often present. Traces of peri- or endocarditis are often to be noted. The rent in the inner coat sometimes precedes, sometimes follows, the distension. A number of rents may occur in the same subject.

Double aorta and dissecting aneurism. The upper and posterior wall of the aorta exhibited an opening one-fourth of an inch in diameter and nearly round. The aneurism had its origin in a rupture, not of the main artery, but in a channel to the left of it. It had stripped off the pleura on the left side and had broken through this, causing the fatal hæmorrhage into that cavity. A careful examination showed that there was a duplication of the aorta from the left subclavian down, the two portions being separated by a complete septum. The right was the larger and was in line with the descending limb of the arch. The left branch did not exhibit arteriosclerosis.

This condition is very rare. Krause cited five examples of double aorta. In view of the fact that in the development of the human embryo the right and left systems of arterial arches fuse together at a very earlier period, it is astonishing that the man should have lived to a good age in health and comfort. Williams (Med. Record, Aug. 1, '96).

As to the etiology of dissecting aneu-

risms, it is probable that neither trauma nor disease plays any part in the majority of instances. It is more than likely that the initial tear in the inner coats is due to the distension of the lumen of the vessels in consequence of the increased action of an hypertrophied left ventricle. That the intima and media, and not the adventitia, should be torn is explained by the fact that the adventitious coat is more elastic than the other two. Flockmann (Münchener med. Woch., July 5, '98).

Aneurisms are sometimes of parasitic origin and caused by embolism or by erosion of the arterial wall from without, —ordinarily due to tuberculous foci as found in cavities in the lungs. Spontaneous aneurisms are common in patients with increased intravascular pressure, as in Bright's disease or valvular disease of the heart.

Every horse has an aneurism, from the size of a pigeon's egg to that of a man's head, in the mesenteric artery of the cæcum, caused by the sclerostomum armatum. Czokor (Inter. klin. Rund., Nov. 26, '93).

Exciting Causes.—Weakness and thinness of the internal and medial coats of the arteries predispose to aneurisms, especially in localities like the popliteal space, subject to frequent movements. Small, incomplete tears occur in the wall of the vessel, and these gradually increase, Violence may then produce a rupture of one or two of the coats of an artery and act as an exciting cause.

An artery may be torn or unduly stretched by a fracture or dislocation, or by attempts made to reduce the latter.

Case of traumatic aneurism of the axillary artery due to attempts at reduction of a dislocation of the shoulder. Death soon after the operation. A small opening found in the axillary artery only large enough to admit the end of a probe; the sac was enormous and during life had not pulsated. The veins, which had been also injured, opened into the aneurism.

Case of traumatic aneurism due to attempted freeing of the shoulder-joint, in a case of ankylosis following gonorrhœal arthritis. Sonnenburg (Berliner klin. Woch., p. 681, July 27, '96).

Any violent or sudden exertion may also act as an exciting cause either by unduly stretching the artery, by forcing blood under a high pressure through it, or by causing the heart to act irregularly and forcibly.

Case of child which, when first seen, when nine days old, had in the left axilla a tumor, soft and compressible, dilating synchronously with the heart, and over which a bruit could be heard, but there was no aneurismal thrill apparent. This tumor had not been noticed at birth by the midwife, but some days later a small, soft swelling was observed which gradually filled the entire axilla. The tumor was flattened and soft, covering the anterior aspect of the shoulder and a small part of the upper arm; beneath, it extended beyond the posterior border of the axillary space. The child had been roughly handled a day or two after birth, during the performance of some occult ceremonial rites, part of which rites consisted in handling the child dangling by one arm from one person to another over the banisters. When shown, child was in excellent health, after having passed, however, through a period of some months' suffering. W. C. Mardorf (Med. Rev., May 14, '98).

Riders are frequently the subjects of popliteal aneurisms. This is due to obstruction of the arteries caused by the bending of the legs and the contraction of the leg-muscles, to which may be added the jars which are constantly given to the column of blood thus formed.

Pathology. — The structure of a sacculated aneurism, from without inward, is as follows:—

1. An adventitious sac formed of condensed areolar tissue.

2. The real sac, which may consist of the thickened external coat and, perhaps, a portion of the middle coat (false aneurism) or of all the coats (true aneurism). The atheromatous and calcareous patches may serve to distinguish the inner and middle coats.

3. Concentric decolorized fibrinous layers, harder and drier toward the exterior and toward the interior softer and redder.

4. A soft, currant-jelly coagulum, which may, however, be formed previous to or after death.

The fibrinous deposit on the wall of the sac acts favorably by diminishing the dilating force of the circulation in the sac and by strengthening the wall. The mouth of the sac is round or oval, and measures much less than a section of the sac.

If the contents of the sac be examined they will be seen to vary according to the stage of the disease. The wall of the sac is very thin in the first stage, and contains fluid blood only; in the second stage the centre only of the sac will contain fluid blood, around which are placed laminæ and fibrin; at the periphery a much thicker wall of fibrin is present. The laminæ of fibrin next to the wall are dry, friable, and opaque, while, as the centre of the aneurism is approached, they are soft and red.

Fibrin is rapidly deposited in sacculated aneurism, being more rapidly formed where the obstruction to the free passage of the blood into and out of the sac is greater.

Many sacculated aneurisms are probably true aneurisms at first, but, on increasing in size, the inner coats of the artery rupture and the aneurism becomes a false aneurism.

In tubular or fusiform aneurism the vessel is also elongated. Several tubular aneurisms may exist in the course of the same vessel, the artery remaining healthy between them.

In tubular aneurism the three coats of the artery are preserved, but the middle coat, not undergoing hyperplasia, its elements no longer form a continuous layer, but are separated one from another. The sac, in this form of aneurism, being, in reality, only an enlargement of the lumen of the vessel, exposed to the full current of the blood, no laminated fibrin is found in it.

As compared to other tissues, the skin resists longest the pressure from aneurism.

Aneurisms are most common in the thoracic aorta (ascending and transverse portions) and next in the popliteal, carotid, subclavian, innominate, and axillary. The most important aneurisms on small arteries are those in the brain, lungs, and heart.

Case of multiple aneurism of pulmonary artery in a boy, aged 12 years, in whom a loud, roaring, pulmonary systolic bruit and very highly-accentuated second sound were present during life, with hæmoptysis, epistaxis, and dropsy. Four of the secondary branches in one lung and three in the other led into aneurisms as large as walnuts, filled with blood-clot. The boy had been ill for a year. Churton (Brit. Med. Jour., May 15, '97).

Case of hepatic aneurism in which the clinical picture included pains in the right hypochondrium or epigastrium, intermittent jaundice, and repeated, profuse hæmorrhages from the upper part of the bowel. The diagnosis is made but seldom, and cholelithiasis or duodenal ulcer is generally thought of, especially since all three symptoms do not always occur together. The most constant of these is the pain. In the pathogenesis trauma plays an important rôle, and rather often there is a history of some preceding infectious disease. A. Sommer (Prager med. Woch., Sept. 8, 1902).

Much of the uncertainty as to the rôle of syphilis in the production of aneurism is due to a failure to recognize syphilitic aortitis, a distinction which is comparatively easy upon post-mortem examination. The predisposition to aneurism is furnished by a weakened aortic wall. This may occur from aortic sclerosis, syphilis, traumatism, and acute inflammatory processes. It is probable that acute traumatism or even greatly increased blood-pressure exercises no effect on a normal aorta. But when as a result of chronic changes in its walls they have become weakened, acute distension may take place. Alcohol plays only a restricted rôle in the development of aneurism. It is important to distinguish syphilitic cases from those due to other causes, as there is a specific treatment for them, though the prognosis is rather bad. If a diagnosis could be made of syphilitic aortitis, the formation of an aneurism could be prevented. F. Schuyzer (N. Y. Med. Jour., Aug. 4, 1904).

Prognosis.—Spontaneous recovery occurs but seldom; a deposit of fibrin due to a slow current takes place in the sac and completely fills it, forming a firm and solid mass. The process may extend still further into the artery, thus rendering the cure still more secure. The formation of an embolus is only to be expected, however, when the diseased artery is small. Spontaneous recovery may occur in other ways: from a clot being washed out of the sac into the artery, forming an embolus which completely arrests the current in the sac, the latter being filled with a firm coagulum.

The sac may also be heavy enough and so situated as to stop the current of the blood in the artery by causing flexion of the aneurismal neck.

In some cases inflammation of the sac and coagulation of the blood contained in it also effect a spontaneous cure.

Only small aneurisms are cured by spontaneous formation of a thrombus in the sac and its conversion into cicatricial tissue.

Death may result in various ways:—

1. By rupture of the sac. In this case death may occur instantly, if the opening be into a serous cavity, one of the pleural cavities (generally the left), or into the pericardial or peritoneal cavities, the serous membrane giving way in a rent.

Cases of rupture of intrathoracic aortic aneurisms met with in the Pathological Department of the Manchester Royal Infirmary.

Number and proportion of cases: Among the last 4593 cases submitted to pathological examination rupture of a thoracic aneurism has been noted in 32 cases. This gives a percentage in all "general" cases of 0.69.

Sex: Of the 32 cases, 30 were men and only 2 women; that is, a percentage of 93.75 males and 6.25 females.

Age: The exact age was obtained in 30 of the cases; the others were middle-aged males. The average was 40 years. The males averaged 40.4 years. The females averaged 34 years. The youngest subject was aged 20 years and the oldest was aged 65 years.

Seat of aneurism: In many instances the greater part of the arch was involved. Grouped, however, according to the chief area of affection, they may be arranged as follows: Ascending portion of arch, 12; transverse portion of arch, 11; descending portion of arch, 4; and descending thoracic aorta, 5.

Point of rupture: This can be best indicated in tabular form:—

Part Ruptured into.	No. of Cases.	Percentage.
Pericardium	13	40.62
Pleura (left)	7*	21.87
Œsophagus	3	9.37
Externally	3	9.37
Trachea	2	6.25
Pleura (right)	1	3.12
Lung (left)	1	3.12
Bronchus (right)	1	3.12
Superior vena cava	1	3.12

* One of these was a case of dissecting aneurism.

Nature of death: Of the thirty-two cases, six were observed in medico-legal investigations, the subjects being brought

dead to the hospital, having been found dead or suddenly seized in the street or elsewhere. In one instance a man, while riding in a cart, suddenly fell out of the vehicle and was picked up dead. In nearly all the cases where rupture occurred while in hospital or where a clear history could be obtained death was sudden, in many instances being practically instantaneous. In one case, where rupture occurred into the œsophagus, death took place in five minutes. In another, where the aneurism burst into the pericardium, the patient felt faint and was dead in three minutes. In one subject, where the pericardium was found filled with blood, and where there was commencing erosion into the trachea, with also extension into the left lung, a small quantity of frothy blood was brought up for some hours before death, which was sudden. In a case where there was general aneurismal dilatation of the arch of the aorta, rupture took place into the pericardium through a vertical slit two and a third inches in length. The patient was brought to the hospital in what appeared to be a syncopal attack, and died suddenly four hours later. In one case where death occurred suddenly, blood-clot weighing eighty-five ounces was found in the left pleural cavity. T. N. Kelynack (Lancet, July 24, '97).

Death is not so rapid when the aneurism reaches to the skin or to a mucous membrane, such as the trachea, œsophagus, intestine, or bladder.

The rupture of an aneurism through a mucous surface occurs by the formation of a small, circular abscess; through a serous surface the rupture is by a fissured or star-like opening. In the skin a small slough is formed, which, on falling, leaves a minute opening, through which the blood passes. This is soon arrested by clotting, but the hæmorrhage soon recurs and death is finally caused by repeated hæmorrhages.

2. Death may occur from the compression of important organs. Pressure upon the trachea, bronchi, or lungs causes suffocation; upon the œsophagus or thoracic duct inanition.

In tubular aneurisms death may be caused by syncope due to impediment to the circulation or by compression of the œsophagus or bronchi or by rupture into the pericardium.

When the vertebræ and ribs are compressed these bones are absorbed and spinal irritation and even meningitis are produced. Pressure upon the intercostal nerves gives rise to severe neuralgia.

3. Inflammation and suppuration of the sac may cause death by inducing septicæmia and pyæmia.

4. If the aneurism is in the arch of the aorta a clot may be carried to the brain by the cerebral arteries, causing embolism and death.

5. Gangrene of an extremity caused by obstruction may cause death by septic infection.

A sacculated aneurism usually forms upon a tubular aneurism and causes death more rapidly than the tubular aneurism alone would have done.

Duration of Aneurism. — Though an aneurism may grow very rapidly, it lasts several years, in the majority of cases. So long as the cause is present it tends to develop.

The various causes which influence the duration of an aneurism are its situation, the size of the mouth of the sac, the condition of the latter, the force of the blood-current, the state of the blood as to coagulation, and the mode of life of the patient.

Treatment of Aneurisms in General.— Obliteration of the sac and occlusion of the afferent and efferent vessels are the aims to be reached.

The best results may frequently be obtained by combining several modes of treatment.

Obliteration of the sac can be obtained by diminishing the force of the circulation of the blood in it, thus encouraging coagulation.

TUFFNELL'S METHOD.—The best-known method in this connection is that of Tuffnell, which, though usually employed for internal aneurisms, has also been advantageously used for aneurisms of the extremities.

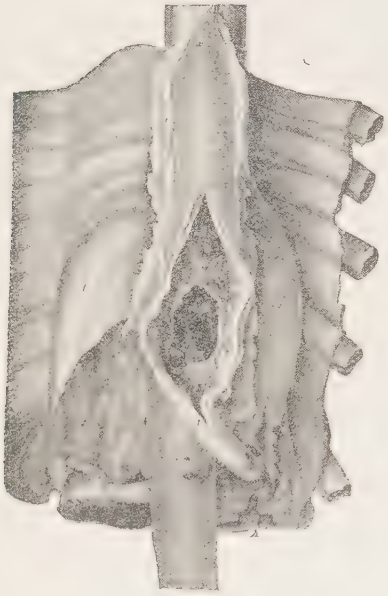
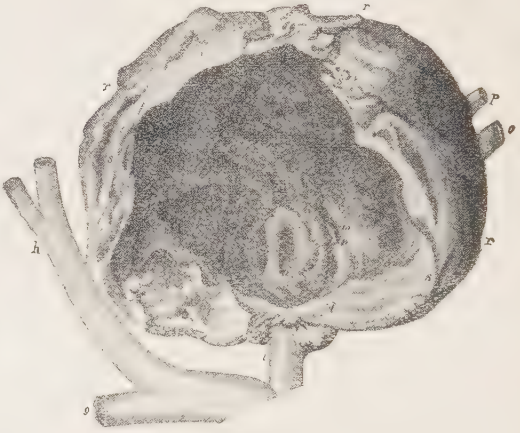


Fig. 1.



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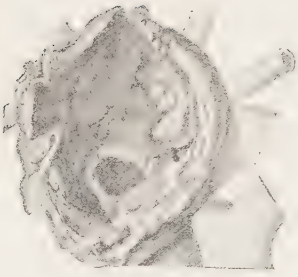


Fig. 2.

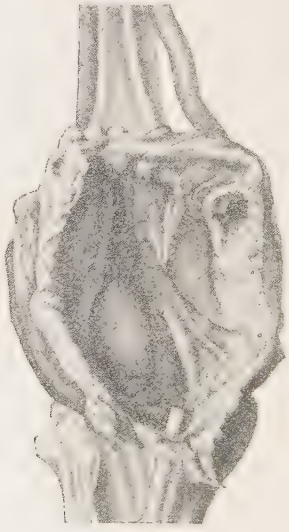


Fig. 4.

Pathological specimens of ruptured aneurisms. (*Scarpa.*)

Fig. 1.—Ruptured aortic aneurism. *a*, Thoracic aorta stripped of its pleura and cellular coat; *c*, *c*, Rupture of the posterior wall of the aorta; *f*, Aneurismal sac covered by the pleura; *h*, Rupture of the aneurismal sac.

Fig. 2.—Ruptured aneurism of the arch of the aorta. *b*, *b*, Bottom of cavity showing the location of the rupture of the artery.

Fig. 3.—Ruptured carotid aneurism. *l*, Inferior orifice of left carotid artery, ruptured; *m*, Superior orifice of the left carotid artery; *h*, Right carotid; *r*, Aneurismal sac.

Fig. 4.—Ruptured popliteal aneurism. *a*, *a*, Ruptured popliteal aneurism farther opened; *b*, Artery; *c*, Superior orifice of artery; *d*, *d*, Portion of aneurism torn.

The object of Tuffnell's treatment is to reduce the watery elements of the blood and to increase the solid elements.

The patient is kept in the recumbent position for at least three months; this causes the rate of pulsation to diminish greatly. In one case it fell in a few days from 96 to 66: a reduction of 30 beats a minute, 1800 beats an hour, and 43,200 beats a day. No drug can cause such a diminution without danger to the patient. The recumbent position, according to Tuffnell, acts upon the circulation in internal aneurism as does mechanical compression in external aneurism. The food is diminished, amounting to but 10 ounces of solid and 6 ounces of fluid in the twenty-four hours.

Tuffnell's food consists of 2 ounces of bread and butter and 2 ounces of milk for breakfast; 2 or 3 ounces of meat and 3 or 4 ounces of milk or claret for dinner; 2 ounces of bread and 2 ounces of milk for supper.

Rest and restriction of liquids are the most important parts of the treatment.

Tuffnell published his first observations in 1875. Of ten cases treated seven were cured and three died during the treatment. One case of popliteal aneurism made a recovery in twelve days.

To induce sleep lactucarium is recommended, and, with the view of diminishing the liquid portion of the blood, the patient is purged from time to time with compound powder of jalap.

Results of study of effect upon the blood of Tuffnell method of treatment, combined with calcium salts, in management of two cases of aortic aneurism. Restriction of fluids caused decrease in elimination of calcium salts, while increase of fluids caused marked increase in their elimination. Water should be given in abundance, if it is desired to saturate the body with calcium salts. Personal cases absorbed much more calcium while taking large quantities of water. Ingestion of calcium seemed to increase the quantity in the circulating blood. Specific gravity of blood was not distinctly affected by the treatment. The plasma-nitrogen, plasma-albumin, and the quantity of albumin in the plasma of 100 cubic centimetres of blood, were constant in the two cases, except at one estimation. The fibrin-nitrogen was not increased. The time of coagulation was reduced in one case, but was not affected by the ingestion of calcium. In the other case the time varied, but was not shortened on the average. Influence of the treatment upon the blood seemed, therefore, entirely negative, although both patients showed distinct improvement in their physical signs. A. E. Taylor (Jour. Exper. Med., May, '98).

Medicinal Treatment. — With the idea that aneurism is often due to syphilis, iodide of potassium has been much employed.

Case of non-syphilitic aneurism in which 30 to 60 grains of iodide of potassium per day, and an ice-bag applied to the tumor, caused the pulsation to diminish, and in five months the patient, a street-singer, was able to resume his occupation. Edouard (Revue de Méd., May 10, '97).

Case of symmetrical aneurism of the ulnar arteries in a syphilitic cured by specific treatment. Chancre on penis in 1862, diagnosed by Ricord as syphilitic. Treated with mercury and iodide for a year without secondaries being noticed. In 1882, gummatous perforation of palate, cured by mixed treatment. A year later, gumma of the soft palate, glycosuria, and albuminuria. In 1888, polyuria and increase in sugar; head ache; small aneurism on each ulnar artery a little above the wrist; tachycardia; retinal hæmorrhages. Diagnosis: Syphilitic arteritis and aneurism; cerebral arteritis; syphilitic diabetes. Treatment by injections of grey oil and 6 grammes of iodide daily. Aneurisms almost disappeared in three weeks. Fournier (La Syphilis, February, 1905).

The calcium salts have been recommended.

Four cases of aneurism in which the amount of calcium salts passed in the urine was much greater than normal; may be useful as an aid to diagnosis. E. Reale (Rivista clinica e terapeutica, Naples, Nov., '91; Brit. Med. Jour., Mar. 26, '92).

Marked improvement from hydrated calcium chloride in doses of 1 drachm daily. Solomon Solis-Cohen (Philadelphia Polyclinic, July 6, '95).

Acetate of lead has been used to "equalize the circulation," and bromide of potassium is frequently employed against the cough and pain.

Gallic acid, iron sulphate, barium chloride, digitalis, veratrum viride, and aconite have been used, but the majority of clinicians do not look upon these agents with favor.

Coagulating Injections. — These have been utilized for aneurisms of the extremities. Tannin, lead acetate, Monsel's solution of iron, spermaceti (Dobell), and other drugs being used.

Cervical aneurisms should not be treated by these injections, lest an embolus be carried to the brain.

To prevent emboli being carried into the circulation the arteries above and below the aneurism should be compressed both during the operation and for some time after it. In the opinion of Tillmann, any treatment by injection is dangerous.

Gelatin Injections.—Injections of liquid gelatin have recently been advocated even in desperate cases.

Operative technique of injection of gelatin for treatment of aneurism is as follows: White gelatin in a quantity of from 1 drachm to 1 1/4 drachms is dissolved in a 7-per-cent. solution of sodium chloride in measure 1 to 2 quarts. The solution is placed in a flask, which is sealed and then sterilized with its contents at a temperature of 120° C. For the injection a flask of the capacity of 1 pint is got ready, fitted with a cork and two tubes like a wash-bottle. The long tube is connected with a sterilized needle and the short tube with an India-rubber air-ball. The gelatin is liquefied in a water-bath at a temperature of 95° F. and poured into the flask, which is also kept in a water-bath. The injection is made slowly into the subcutaneous tissues of the buttock and should take fifteen minutes. It should be repeated every six or eight days until the sac is obliterated. This method, if carried out with care, gives excellent results in the most desperate cases. Lancereaux (Paris Academy of Med.; Lancet, Nov. 19, '98).

Injections of gelatin in aneurism. Case of aortic aneurism in which the size of the tumor was much reduced after 10 injections (1 1/2 ounces each) of gelatin solution. The following formula is suggested:—

℞ White gelatin, 15 grains.
Salt, 7 1/2 grains.
Hot water, 26 ounces.

This mixture is sterilized and allowed to cool. When required for use it is warmed to fluidity and injected under the skin with antiseptic precautions. The injections may be given every few days, or even every day. After the injections the patients should remain absolutely quiet in bed. Frankel (Deut. med. Presse, June 9, '99).

Nine cases treated with gelatin suggest the following conclusions: 1. In no case did cure of the aneurism result, and only in one was there considerable improvement. 2. In seven cases there was an appreciable lessening of the pressure symptoms. 3. The coagulability of the blood is greatly increased. 4. The injections often cause a good deal of pain. 5. The injections are sometimes followed by rigor and fever. 6. The treatment affords amelioration, and is deserving of further trial. Futcher (Jour. Amer. Med. Assoc., Jan. 27, 1900).

Treatment of aneurisms with gelatin in several recent cases. Complete cure of a large aneurism by total obliteration of the sac is obtained only after a variable

number of injections of gelatin, according to the case, but approximately from 25 to 30 at the least. Lancereaux and Paulesco (Gaz. des Hôp., July 17, 1900).

Three cases of thoracic aneurism treated by gelatin injections. They were under observation in the Hudson Street Hospital. None of them was successful. The cases were not under observation long enough to give data for a final conclusion, but the result seems sufficient to indicate that gelatin injections not only do no good, but cause severe pain locally and often considerable constitutional reaction. Lancereaux's method was to take 1 to 1¼ drachms of gelatin and make a solution of it in 200 cubic centimetres of normal salt solution. This was kept for several days at a temperature of 38° C. If no cloudiness developed nor any other sign of micro-organismal growth the liquid was injected subcutaneously, usually into the patient's thigh. After about a week another injection was made and the treatment continued at regular intervals. Special directions were given by Lancereaux not to palpate the aneurism during the course of the treatment. At first, a 2-per-cent. solution of gelatin was used; later, however, he used a 1-per-cent. solution. Attention is called to the fact that, if Lancereaux's directions were followed, the patient would be given twenty injections covering a period of five months. During all this time the patient should rest in bed. Rest is sufficient of itself to relieve greatly the subjective symptoms of aneurism, and often does away with certain of the physical signs and even lessens the size of the aneurism. Lewis A. Conner (Med. News, Aug. 11, 1900).

The injections are often followed by fever and pain. The possibility of extensive coagulation and of embolism has not been demonstrated. The injections may cause increase of vascular pressure and involve rupture of a large-sized aneurism whose walls are thin. The clinical observations so far made do not warrant an exact estimate of the value of the gelatin treatment. Henri Grenet and G. Piquard (Archives Générales de Méd., June, 1901).

It has also been affirmed that the gelatin method is painful and liable to cause fever, but if the solution be gently injected into the subcutaneous tissue of the thigh, it is absolutely painless, and if proper antiseptic precautions are observed there is no fever. The authors insist upon these details, as showing that the ill success attributable to this method of treatment depend entirely on a faulty technique. Lancereaux and Paulesco (Bull. Acad. de Méd., Paris, July 16, 1901).

Gelatin injections may, with proper precautions, be given subcutaneously with safety. They produce a marked and speedy decrease in all of the subjective and in some of the objective symptoms presented by internal aneurisms. This relief of symptoms is only explainable on the theory of a diminution in pressure effects from shrinkage in size of the aneurismal sac. The diminution in size, accompanied with marked increase in resistancy of the tumor wall, was capable of physical demonstration in three of the cases treated. The after-histories of the patients, so far as they could be obtained, afforded evidence that probably the beneficial results were permanent. G. Rankin (Lancet, July 11, 1903).

Subcutaneous Injections.—Langenbeck recommends subcutaneous injections of ergotine, which act in two ways: by slowing the action of the heart, thus favoring the deposit of fibrin, and causing contraction of the unstriped muscular fibre entering into the composition of the middle coat of the artery, thus raising the blood-pressure.

Compression.—Compression was used over two hundred years ago for cases of traumatic aneurism, but the first surgeon to propose this method was Heister. In 1772 Guattani, an Italian, compressed the entire limb and the sac in cases of popliteal aneurism. Cases thus treated usually, however, ended fatally, from transformation of the circumscribed aneurism into a diffuse aneurism, inflammation and suppuration of the sac, and

gangrene of the leg. The mortality was 50 per cent.

John Hunter, in 1785, introduced into the treatment of aneurism the governing principle that the current of the blood through the sac should not be completely suppressed, but only diminished, thus allowing the elasticity of the sac to act. In this way the effect of the overpressure from the heart's action is removed.

The fact that the sac in diffused and traumatic aneurism is not contractile explains why this treatment is without success in aneurisms of this variety.

Advantages of compression over ligation:—

1. It is not so dangerous; if necessary, it can be discontinued and then renewed, whereas, in ligation, the danger may be great for many days following the operation.

2. In cases treated by compression only the sac consolidates, just as in spontaneous cure. The arteries, up to the point of compression, are not consolidated, as in ligation.

3. Compression is more successful than ligation, and does not present danger of complications, such as secondary hæmorrhage, sloughing of the sac, phlebitis, gangrene, or pyæmia.

4. Ligation has been followed by a second aneurism or by suppuration in the sac. Though these complications may occur after compression, they are not likely to do so, and consequently compression is more likely to be permanent than ligation.

Compression may be applied with the fingers or by means of various instruments, bags of shot, Esmarch's elastic bandage, flexion of the joints, etc.

Jonathan Knight, of New Haven, Conn., first employed the finger as a means of compression in 1848, and in the same year Willard Parker and James R. Wood, of New York City, each successfully treated an aneurism in this manner.

Digital pressure over the vessel, just above the aneurism, is applied by a succession of assistants relaying one another. The procedure is rendered much less irksome for the operator by placing a weight upon the pressing fingers, the muscular strain being thus, in a measure, relieved.

It is necessary to keep up the pressure from one to several days, until the pulsation has ceased. The average time required is three days. The pressure should then be gradually diminished, in order to prevent disintegration of the clot before it is firmly contracted.

In proximal compression of the artery it is only necessary to stop the pulsation of the sac, it being unnecessary to stop the flow of blood through it. This method succeeds best in sacculated aneurisms. In tubular aneurisms it causes gradual contraction, but not by a deposit of fibin.

When the sac contains fluid blood only, the chances of success are more favorable. In an already partly-filled sac coagulation may be too sudden and imperfect.

Recovery is shown, when compression above the sac has been resorted to, by cessation of pulsation in the sac when pressure is removed, by no thrill or bruit being present, and by the development of a collateral circulation.

The collateral circulation which develops after the sac has been filled with fibrin indicates that the sac has been obliterated.

Sudden enlargement of the collateral circulation, occurring both in cures happening spontaneously and in those due to compression, may cause considerable

pain. The latter, therefore, may be looked upon as a favorable symptom.

In aneurisms of the extremities and neck compression gives good results. This causes, when cure takes place, the formation of coagula in the aneurismal sac, through or alongside of which, however, a canal remains through which the blood passes. The coagula shrink gradually and become more solid and firmly adherent to the inner wall of the aneurismal sac. Compression can be carried out only with intelligent patients. Billroth (Wiener klin. Woch., No. 50, '93).

[When compression has ultimately to be abandoned, its temporary use is of advantage in so far as it prepares the way for establishment of the collateral circulation. JOHN H. PACKARD, Assoc. Ed., Annual, '92.]

Compression by means of the contractile power of ordinary collodion, in small aneurisms; successful in three cases. Williams (Amer. Medico-Surg. Bull., Apr., '93).

Compression by the Esmarch Bandage. —In this method it is sought to produce red blood-clot, such as is formed when the blood no longer circulates, and not the fibrinous, or white, blood-clot, such as is formed when the blood is in motion. Such a clot contracts, but does not become organized, and acts mainly by forming a thrombus in the afferent and efferent vessels.

Pressure by means of an Esmarch bandage was first successfully employed by Reid, of the British navy, in 1875, though in 1864 Murray had already succeeded in treating an aneurism of the abdominal aorta by anæsthetizing the patient and checking the circulation completely by means of an instrument. The patient should first be given an hypodermic injection of morphine, then just enough ether as an anæsthetic to prevent pain and insure quiet.

After placing a piece of chamois-skin over the artery to prevent chafing, the limb is firmly wrapped in an elastic bandage from its extremity up to the tumor; the latter, however, is lightly covered over; but, as soon as it is passed, the bandage is again firmly applied, thus allowing a certain amount of fluid blood to remain in the sac.

A tourniquet is then placed above the aneurism, to prevent disintegration of the clot in the sac and of the thrombi in the arteries by the circulation, and left *in situ* from sixteen to twenty-four hours. The pressure is then gradually decreased by unscrewing the tourniquet, while due attention is paid to the state of the circulation, to avoid gangrene by too prolonged pressure, and to avoid disturbing the clot before it is solid.

A collateral circulation is soon formed. Danger may arise in some cases from the sudden rise and fall of blood-pressure or from rupture of the sac; pressure on the nerves, gangrene, and momentary renal disorders are possible sequelæ.

Pressure may be advantageously aided by the administration of iodides and a limited albuminous diet.

The contra-indications to this treatment are vascular degeneration elsewhere than in the aneurism, renal disease, or inflammation of the sac.

But few appropriate cases in which compression in some form has been faithfully persevered in for a long time have been unattended with improvement.

The method of applying compression preferred by Tillmann is to envelop the limb with an elastic bandage from its extremity up to near the aneurism for about an hour and a half; a tourniquet should then be applied above the aneurism, and removed with the bandage an hour and a half later. Digital or instrumental compression should follow for from six to twelve hours.

Compression by Flexion. — This method, which was first employed in

1858 by Hart, can only be used for the arm and leg. It consists in bandaging the entire extremity, and then flexing it strongly: the forearm upon the arm, the leg upon the thigh, or the thigh upon the pelvis.

The effects of this method are to compress the sac itself, to retard the circulation through it, and occasionally to cause a small clot to be dislodged, by means of which the mouth of the latter becomes occluded.

Flexion of the joint can be used only in aneurisms of small or medium size; when the tumor is large the sac might be ruptured. It is an unsafe procedure when the sac is inflamed or when there is much œdema of the leg.

Flexion is especially indicated when the tumor is of small size, the sac not inflamed, and the joint not involved.

An argument in favor of flexion is that if unsuccessful no harm follows the procedure.

Macewen's Method.—The object of this method is to form white thrombi within the sac, by lightly scratching the internal surface of the sac with needles thrust through the previously-asepticized wall. The needles are thus left in contact with the sac until the entire wall has thus been lightly irritated. The position of the needle-points should be changed at intervals of ten minutes. It may be necessary to continue this for forty-eight hours, the sittings being repeated from time to time for weeks or even months. Besides the effect upon the aneurismal currents there occur an infiltration of the parietes with leucocytes and a segregation of them from the blood-stream at the point of irritation.

> The advantage of white thrombi over the red is in the less marked tendency of the former to shrink in volume or to undergo penetration by leucocytes or yellow softening. The object is to obtain an adhesion of leucocytes to the vessel-wall, and to promote successive accretions of these bodies (a parietal thrombus) until complete occlusion occurs. For this purpose a slender pin of sufficient length is employed to transfix the aneurism and to permit manipulation, in order to scratch the inner surface of the opposite wall at various points over its entire extent. Sometimes this can be accomplished by one insertion, but it may be necessary to thrust the pin in at several points. Antiseptic precautions are, of course, to be observed. The length of time during which the pin is to be kept in place varies, but should never exceed forty-eight hours, and may be much less. In the case of a very large aneurism several pins may be introduced at various points, but they should not be too close together. Every aneurism contains within itself a potential cure as the essential matter, whatever may be the method devised for inducing its action. Macewen (Lancet, Nov. 22, '90).

An antiseptic gauze dressing should be applied to the neighboring region while the needle is left in the sac.

One needle usually suffices, but it may be necessary to use two or three.

Any superficial ulceration, inflammation of the sac, or erysipelatous induration is a contra-indication.

Needles may also be used to transfix the aneurism or for the purpose of causing coagulation, as in electrolysis.

In *acupuncture* very fine gilded needles are introduced into the sac, crossing one another, and thus forming a centre around which the blood coagulates. They are removed several days later. This method is seldom, if ever, successful.

In *galvanopuncture* two insulated needles are introduced into the sac at about an inch apart, and being brought into contact by their internal extremities a galvanic current is passed through them. This method was proposed by Phillips in 1829. It exposes to embolism, suppura-

tion in the sac, and hæmorrhage through the needle-punctures.

Electrolysis Through Introduced Wire.—The introduction into the sac of filiform material, especially wire, as recommended by Moore (see below) having given evidences of value, D. D. Stewart, of Philadelphia, showed the great advantage of combining electrolysis with the introduction of wire in sacculated aneurisms, and has published cases in which satisfactory results were obtained. The aneurisms treated were not susceptible of cure by medical or surgical means. The procedure is a distinct advance in curative means.

> Final report of a case of a very large innominate aneurism completely cured by the employment of electrolysis through ten feet of snarled, coiled, fine, gold wire, introduced into the sac; death at the expiration of three and a half years from cerebral thrombosis. The newer method consists in introducing into the sac, under the strictest antiseptic precautions, a fine silver or gold, coiled wire, previously so drawn that it may be readily passed through a thoroughly insulated needle of somewhat larger calibre than the wire and, after introduction, assume snarled spiral coils, that, with a moderate amount of wire, the entire calibre of the sac will be reached, unless the cavity be already filled with coagula or the sac be of unusual size (as was the case with one aneurism so treated).
>
> The wire must be neither, in amount or calibre, too great nor too bulky or highly drawn that the results to be desired be interfered with. Nor should the wire be of a material so brittle as steel nor of hard-drawn iron, lest fracture occur in process of contraction of sac, with danger of rupture. Nor should it be of soft iron, as was recommended on theoretical grounds by Stevenson; for, with the last, so great a quantity of detritus will result, due to the decomposition of the iron and the formation of insoluble salts under the current's influence, even with low ampèrage, that danger of emboli result.
>
> Silver or gold wire is undoubtedly preferable material.
>
> The amount of wire required depends necessarily upon the calibre of the aneurismal sac, and must be decided upon with the greatest nicety of judgment, since with too small an amount little or no result will be obtained, and, with too great a quantity, permanent cure through obliteration of sac by contraction of clot cannot be expected. For a globular sac of approximately three inches in diameter, three to five feet are sufficient; for a sac of four to five inches, eight to ten feet.
>
> The anode, or positive pole, should invariably be the active electrode. This is connected with the wire and the negative rheophore—a large clay plate, or an absorbent cotton pad of equal dimensions made after the method of Massey—is placed upon the abdomen or the back. The current is slowly brought into circuit and its strength noted by an accurate milliampèremeter. The increase is

Case of aortic and innominate aneurism, with erosion of the clavicle and ribs. Photograph was taken thirty-five months after Dr. D. D. Stewart had caused an arrest of the growth of the aneurism by electrolysis.

gradual for a few moments until the maximum strength supposed to be required is reached. It is maintained at this until the approach of the end of the session, and then gradually diminished to zero, after which the wire is separated from the battery, the needle carefully withdrawn by rotation and counter-pressure, and the released external portion of the wire gently pulled upon and cut close to the skin, the cut end being then pushed beneath the surface. This latter procedure is facilitated by using care in the introduction of the needle to first draw the skin at the site of puncture a trifle to one side, in order to procure a somewhat valve-like opening.

Experience has shown that the current-strength must be rather high—from 40 to 80 milliampères—and the sitting long—from three-fourths of an hour to one and a half hours. Thus used, the following effects may be expected: The mere introduction of coiled, snarled wire without the conjoint use of galvanism, if practiced judiciously, is in itself a method of value, since the presence of wire, if engaging all parts of the sac, acts both as an impediment to the blood-stream and at the same time offers to the eddies set up multiple surfaces for clot-formation. Hence this method has more to commend it than that by mere galvanopuncture with needles. By galvanopuncture, although firm coagula are produced, they are of such trifling dimensions and engage such small areas of sac-wall that, without impeding in the least the blood-current, their dissolution rather than their accretion quickly follows. By the application of a strong galvanic current through coils of wire so disposed that all areas of the sac are reached, it follows without exception, as has been noted in all recorded cases, that consolidation by virtue of clot-formation is promptly and invariably produced. The solidification is rapid, and is generally manifest before the end of the electrical session, through changes apparent to the eye and hand, in the pulsation and in the degree of consistence of the sac-wall. These changes become more decided in the course of a few days, until, after a time, in the most favorable cases a hard nodule, with a communicated pulsation only, replaces the previous expansible tumor. This was the history of four of the ten cases now recorded,—that of Kerr, that of Rosenstein, the second case of author's, and the case of Hershey,—and partially so in the case of Barwell, of Roosevelt, and in the first of the author's, all of which latter cases were totally beyond the slightest hope of cure at the time of treatment, as was also the case of Abbe. D. D. Stewart (Brit. Med. Jour., Aug. 14, '97).

Treatment of abdominal aortic aneurisms by a preliminary exploratory cœliotomy and peritoneal exclusion of the sac followed later by wiring and electrolysis. The main difficulty lies in the fact that a determination of the situation of the aneurism, even when a cœliotomy is performed, is very great. The objections to the method are as follow: 1. The cure of the aneurism may lead to the death of the patient by obliterating the orifice of important visceral arteries; this is most likely to occur in dealing with aneurisms of the upper or cœliac division of the abdominal aortic tract: *i.e.*, in about 50 per cent. of the cases. 2. Secondary rupture of the sac from the strain put upon weak portions of the sac in multilocular aneurisms, after partial coagulation of the contents has taken place (particularly likely to occur in subjects of general endarteritis with atheroma). 3. Escape of wire through a large aneurismal orifice into the lumen of the aorta, with migration upward into the heart, leading to perforation, traumatic endarteritis, endocarditis, with the formation of secondary thrombi and emboli. 4. Danger of perforating the sac by stiff wire or by overcrowding the sac with too much wire. 5. Danger of extension of clot from the coagulum in the aneurism to the main artery, leading to fatal blockade at the bifurcation, with gangrene of the lower extremities. 6. Danger of rupture of sac from sudden withdrawal of abdominal support and displacement of adherent organs in the course of the exploratory laparotomy. 7. Danger of mistaking a fusiform for a

sacciform aneurism. 8. Danger from emboli and thrombi following incomplete coagulation of the blood in the sac (a very rare and practically unknown occurrence in abdominal cases). 9. Danger of shock. 10. Danger of sepsis. Rudolph Matas (Amer. Medicine, June 22, 1901).

Case of aneurism in which temporary improvement by wiring and electrolysis obtained, the patient dying later as a result of rupture of the sac. From an experience of eight operations of this character he concludes that electrolysis in properly selected cases of aneurism is a valuable measure and prolongs life. The operation itself is neither dangerous nor painful. The failure of permanent cure does not depend so much upon the failure of the operation to limit the disease locally as to the fact that the adjacent parts of the blood-vessel are weak, and, when the bulging area is solidified by the clot, these lateral areas may later on give way. Even in these cases life is prolonged by the closing of the weakest area, and it is not to be forgotten that in at least one case (Stewart's) life was prolonged three years, death taking place from an alcoholic debauch. Hare (Therap. Gaz., Jan. 15, 1903).

Introduction of Foreign Bodies into the Sac.—Catgut, silk, horse-hair, fine wire, especially, have been introduced into the sac to promote coagulation, but this measure does not meet with the approval of the profession.

Antyllus's Operation.—The oldest operation is that of Antyllus (fourth century), which was at first employed only for small traumatic aneurisms of the elbow. It consisted in tying the artery above and below the sac, opening the latter, and removing its contents. It was often attended by suppuration, secondary hæmorrhage, and ankylosis, owing to the fact that the artery was tied immediately above and below the sac, the artery being itself diseased in these regions.

In 1710, Anel, believing that the sac would collapse, tied the artery above the aneurism, but the true cause of success in such cases was not discovered until, in 1785, John Hunter proved experimentally that aneurism was not due to localized weakness in the vessel, but to a pathological condition of the arterial wall, extending beyond the sac.

The Antyllus modified operation may be exceedingly difficult, on account of branches springing from the sac, and from the artery above and below the sac being so thickened as to make it almost impossible to tie them. After emptying the sac a probe should, therefore, be passed into the arteries above and below, and the latter only then tied.

When it is too difficult to remove the sac entirely a portion may be left behind.

Hunter's Operation. — In the Anel method the artery was tied too near the sac, where the diseased arterial wall did not allow the ligatures to hold firmly; by Hunter's method the artery is tied at some distance above the sac, where it is healthy. The sac does not collapse; the force of the circulation is simply diminished, allowing the sac and its contents to be absorbed.

Slight œdema of the limb is not a contra-indication for Hunter's operation, but the aneurism should be of slow growth, of moderate size, and the sac not inflamed. It should not be performed in multiple aneurism, except if there are only two, and these can be operated on simultaneously.

This operation may be followed by return of pulsation in the sac, and recurrence, secondary hæmorrhage, inflammation and suppuration of the sac, gangrene, pyæmia, and septicæmia.

In performing Hunter's operation it is advisable to make distal compression for a few seconds before tightening the ligature, so as to distend the sac, and to

ascertain, by digital compression, that the pulsation can be entirely arrested.

A rise in the temperature of the limb is observed after the operation, according to Holmes and Ashhurst. According to the majority of writers, however, the temperature first falls, rising only when the collateral circulation is established.

After the operation two sets of vessels are formed for the collateral circulation: one around the point tied, the other around the aneurism.

In a very few cases the sac will be obliterated, but a narrow channel will still be left for the passage of the blood. As the aneurism itself has caused previous dilatation of the neighboring vessels, those forming the collateral circulation around the sac develop earlier in cases where two sets develop. If the aneurism be tied near the sac, but one set of collateral vessels is formed.

Secondary aneurism, or pulsation, may occur in from a few hours to several months after consolidation and contraction of an aneurismal sac; but in most cases it forms about twenty-four hours after the new sac, being generally slightly higher up on the artery than the old sac. Recurrent pulsation is due to the upper anastomotic arch allowing too much blood to flow into the artery between the point of ligation and the sac. Though in some cases as distinct as before the operation, it usually consists in a mere *thrill*, without *bruit*.

Pulsation in the sac may also be caused by too rapid collateral circulation being re-established above the sac.

Recurrent pulsation is best treated by raising the limb, compressing the sac moderately, and using cold with care. If this is unsuccessful, the artery may be tied lower down. But, if there is danger of sloughing of the sac, amputation should be performed in axillary or popliteal aneurism, and Antyllus's modified operation in cervical or inguinal aneurism. The prognosis of cases of recurrent pulsation is usually favorable, as it will usually disappear when the sac consolidates. (Ashhurst.)

Secondary hæmorrhage is most likely to take place from the seventh to the fifteenth day, and on the upper than on the lower limb, owing to the more abundant arterial anastomosis on the former. It is favored by the presence of large branches given off close to the point of ligation. Strong, well-prepared, chromicized catgut is less likely to be followed by secondary hæmorrhage than silk.

If after ligation the tumor enlarges, but without pulsation, it is due to blood coming from the artery beyond the sac. The obstruction of the venous circulation caused by this may give rise to gangrene. However, in most cases the blood coagulates, and the aneurism forms a solid fibrinous tumor.

Suppuration and sloughing of the sac after Hunter's operation may be due to recurrent pulsation from want of consolidation due to an imperfectly developed lower collateral circulation, or to total sudden coagulation of the blood in the sac, from complete arrest of the circulation, from violence or handling of the tumor. Death results in about 25 per cent. of cases where the sac bursts.

Hæmorrhage is most common in cases where recurrent pulsation has occurred; if suppuration is delayed, no hæmorrhage may occur, owing to the arteries communicating with the sac having become sufficiently occluded.

Gangrene occurs usually from the third to the tenth day. It is always moist gangrene, and is most frequent in the lower limb. In some cases it may be prevented

by opening the sac and removing its contents in order to relieve the pressure on the veins. When gangrene is really present, the upper limb should be removed at the shoulder-joint, in most cases, and amputation at the junction of the upper and the middle thirds of the thigh, in the lower limb. (Ashhurst.)

Ligation Below the Sac.—Among the methods best known are Brasdor's, in which the artery is tied below the sac, thus completely arresting the circulation, and Wardrop's operation, in which the artery or a branch is tied below the aneurism, so as to allow the passage of the blood through another branch or branches, thus only partially arresting the circulation. Brasdor's operation is used in aneurism of the carotid, external iliac, etc., and Wardrop's operation in aneurism of the innominate artery or of the arch of the aorta, where the carotid or subclavian or both may be tied. Ligation below the sac is considered as very unreliable. The sac is likely to increase in size, being still subject to the impulse of the heart.

Extirpation was first proposed in the fourth century by Philagrius, of Macedon.

After cutting down freely upon the aneurism, two ligatures are placed around the artery above the sac, and the artery is divided between them. The sac, with its contents, is then dissected out, and a double ligature is applied to the artery below the sac. The vessel is divided between these two ligatures.

This operation presents certain special advantages over compression, proximal ligation, or other methods, namely: the permanence of the cure, the absence of secondary hæmorrhage, and the absence of danger of emboli or of infection.

Its mortality, too, is lessened, having been estimated by Delbet at 11 per cent., whereas that of proximal ligation is 18 per cent. Again, gangrene occurs in but 3 per cent. after total extirpation, against about 8 per cent. after proximal ligation.

Extirpation is indicated when the sac has ruptured, when other methods have been unsuccessfully tried, and, above all, in traumatic aneurisms, especially those of the extremities. It is especially indicated in all aneurisms of the forearm and leg, where the sac has ruptured and caused sudden enlargement, and where rupture is impending. It is also recommended in recent traumatic aneurisms, and in arterio-venous aneurisms where operation is indicated.

Statistics of treatment by extirpation: In 1888 the mortality was between 11 and 12 per cent., but in the 76 cases since reported there is not a single death. Of 109 cases treated by simple ligature, 12 had gangrene, while, of the 76 cases extirpated, there were only 7 instances of this accident, and in 4 of these the gangrene existed before the operation. Recurrence is also one of the dangers of ligation, but it is much less apt to take place with extirpation—if, indeed, it is possible. Delbet (La Semaine Méd., Oct. 30, '95).

Results of 86 cases treated by extirpation. Of these, 27 were idiopathic, 59 traumatic, 29 occurred in the popliteal artery, 14 in the femoral, and the others were distributed tolerably equally over the remainder of the arterial system. Only 3 deaths ensued: 1 from hæmorrhage during the operation, 1 from secondary hæmorrhage, and 1 after amputation for gangrene. Gangrene occurred in only 2 cases (2.3 per cent.), and secondary hæmorrhage in but 1 (1.1 per cent.). In contrasting this method with others, it becomes evident that the percentage of cases in which gangrene occurs is less than after ligature of the main trunk above, while there is here no possibility of local relapses. The advantages claimed over the old-fashioned method of Antyllus are the following: 1. The length of the after-treatment is immensely diminished, since in many cases

it is possible to obtain primary union. 2. The risk of subsequent bleeding is greatly lessened, since all the collateral branches are secured, and it was from these that it usually arose, and not so much from the main trunk. 3. The presence of a thickened cicatrix, which included the doubled-up and wrinkled sac-wall, was likely to lead to interference with the utility of the part, when, as at the knee, the aneurism occurred in the flexure of a limb. Kopfstein (Wiener klin. Rund., Nos. 11-16, '96).

Advantages of the treatment of aneurisms by excision: 1. If the operation can be successfully performed the result is a complete cure of the aneurism. 2. The ligatures have the advantage of being applied to the ends of the divided vessels, and not to them in their continuity. 3. Even if the corresponding vein is divided and a portion of it removed the risk of gangrene is not great. 4. That in this method all the advantages of the antiseptic treatment can be obtained, in connection with the successful healing of the wound and closure of the vessels where divided. 5. Inflammation and suppuration of the sac or rupture of it cannot occur in connection with this method. 6. Although as yet more experience is required, it seems likely that certain aneurisms, such as the subclavian, will in the future be treated more successfully by this method. T. Annandale (Scottish Med. and Surg. Jour., Oct., 1900).

Aortic Aneurism.

Symptoms. — Aneurisms may be divided into three groups: (1) those which are entirely latent, giving no physical signs; (2) those giving signs of intrathoracic pressure, but in which the nature of the cause cannot be ascertained; (3) aneurisms which form distinct tumors and give well-marked pressure symptoms and external signs. (Bramwell.)

Aneurisms of the ascending portion of the arch are those most liable to affect the sympathetic. Reflex dilatation of the pupil may thus be caused; the face may be pale. When the cilio-spinal branches are destroyed the pupil is contracted; the vessels of the side of the head may be dilated. Congestion and unilateral perspiration are also, though less frequently, observed.

Tugging on the trachea is a valuable symptom, and may be detected in the following manner: The patient's head being inclined forward to relax the neck, and the cricoid cartilage being grasped between the index and the thumb, the trachea is drawn upward. If an aneurism is present a well-marked ascending motion will be felt at each pulsation.

Olivier's symptom for diagnosis of aneurism of thoracic aorta, systolic pulsation of the larynx and trachea, is not to be expected in all aneurisms of the aortic arch, but is especially to be observed, either when the aneurism is situated exactly at the intersection of the aortic arch and bronchus or when, if the aneurism is situated at the beginning of the arch, it is adherent to the anterior wall of the trachea. The only other pathological condition which one might expect to produce similar symptoms is a tumor in the anterior mediastinum. This must hold certain relations to the aortic arch, either through pressure exerted by the arch, the tumor is pressed against the bronchus, or it must be adherent to the convexity of the arch and to the trachea. A. Fraenkel (Deutsche med. Woch., Jan. 5, '99).

At times a systolic murmur is caused in the trachea by the air being forced out of it during the systole. The sound, however, may also be caused by the sac. It may be heard at the patient's mouth when the latter is well opened. Traction of the tongue causes this symptom to become more distinct.

In two cases a rhythmical shake of the head observed, synchronous with the cardiac systole and due to downward traction of left bronchial tube and trachea by the aneurism at each diastole. Feletti (La Semaine Méd., Nov. 6, '95).

Pain is especially marked in deep-seated tumors. Angina pectoris frequently occurs in aneurisms situated at the root of the aorta.

Cough in thoracic aneurism may be due to bronchitis, or it may be caused by pressure on the trachea. The expectoration is at first abundant and watery; later on it is thick and turbid.

On percussion large aneurisms present abnormal dullness. This dullness is toward the right when an aneurism of the ascending arch is present, and more to the centre and left in those of the transverse arch. Aneurisms of the descending portion of the arch show dullness in the left interscapular region: *i.e.*, in the space between the spinal column and the scapular border.

A ringing, accentuated, second sound, heard over a dull region, is frequent in large aneurisms of the arch.

Absence of pulse in the abdominal aorta and its branches is observed in cases of large thoracic aneurism.

> Case of aneurism of the aortic arch in which the pulse of the carotids and right radial arteries had the reversed character of the pulsus paradoxus. There was a very marked diminution in the volume of the pulse during expiration, and with the respiratory variations there was a definite anacrotic wave. Post-mortem examination showed an aneurism involving chiefly the posterior portion of the aorta in the region of the transverse arch. The left carotid and innominate arteries sprang from the anterior surface of the arch instead of from the convexity, on account of the distension of the aorta. With each expiratory excurse these blood-vessels were compressed against the bony thorax-walls. J. Hay (Lancet, Apr. 27, 1901).

Inspection is negative in many cases of aneurism of the aorta, but in some abnormal pulsation or a diffuse heaving impulse may be perceived, usually in the first or second right interspace. Throbbing may be seen at the sternal notch or in the neck when the innominate artery is involved. A tumor may be visible in front or in the rear, usually in the left scapular region.

Dyspnœa may be due to compression of the recurrent laryngeal nerves, of the trachea, or of the left bronchus.

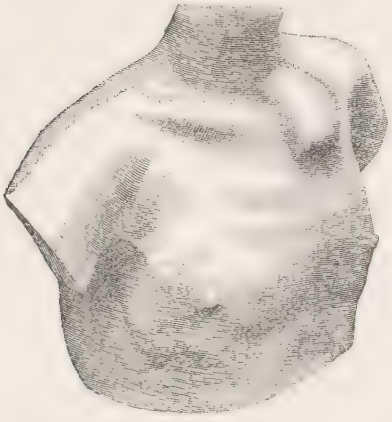
Pressure on this nerve, especially on the left one, causes hoarseness and loss of voice. This may be due either to spasm or paralysis of the muscles of the left vocal cord. Abductor paralysis may be the only symptom of aneurism.

> In the early diagnosis of aneurism of the arch of the aorta, attention is called to the fact that pressure upon the recurrent nerve from aneurism or thoracic tumor does not necessarily produce aphonia. The only subjective symptom of this stage may be a more or less constant laryngeal cough. There may also be dyspnœa from pressure on the brachial plexus with consequent bronchial spasm. A frequent indication of aneurism of the aorta is pain in the region of the fifth or sixth dorsal vertebra. Auscultation of the left interscapular space may reveal an arteriodiastolic murmur not heard elsewhere, or else a systolic murmur due to the beating of the aneurismal sac against the left bronchus. Another auscultatory phenomenon is the presence of the systolic sound or thud in the brachial artery similar to that observed in aortic insufficiency. W. Porter (N. Y. Med. Jour., Dec. 9, '99).

> Early diagnosis of aortic aneurism. Series of 54 cases in which 38 had paralysis of the left recurrent laryngeal nerve, 5 of the right nerve, and only 1 of both nerves. In all these cases the patients first consulted the author on account of hoarseness. Tracheal buzzing was present in 19 out of 31 cases. It is best felt when the cricoid cartilage is pushed upward with the index and middle finger of the right hand, the head of the patient

being bent a little backward. A pulsation downward is felt which ought not to be confused with the general pulsatory vibration of the larynx that occurs not infrequently in excited patients. Moritz Schmidt (Med. Chronicle, Mar., 1900).

Hæmorrhage from the air-passages may be produced in three ways: (*a*) by the formation of granulation tissue in the trachea where it is compressed, in which case the bleeding is not abundant; (*b*) by the sac breaking into the trachea or bronchi; (*c*) by the lung-tissue being eroded or perforated. A patient may recover and live for years even after pro-



Aneurism possibly arising from one of the pulmonary sinuses of Valsalva. (*Shober.*)

fuse hæmorrhage occurring as the result of aneurism.

A relatively frequent phenomenon is repeated occurrence of hæmoptysis preceding the opening of the sac into the bronchial tubes, due to the existence of a small communication between the aneurism and the latter. Hampeln (Berliner klin. Woch., Dec. 24, '94).

Dysphagia may be due to spasm of the œsophagus or to compression. Perforation may be induced by the passage of an œsophageal bougie. This instrument therefore should not be used.

Ascending Portion of the Arch.—Aneurisms in this region may be situated just above the sinuses of Valsalva, or somewhat higher, on the convex border of the ascending arch. In the former case they may be small and latent, and their rupture into the pericardium (usually causing instant death) be the first indication of their existence. When this does not occur aneurisms in this region may become exceedingly large and project into the right pleural cavity or forward, after destroying the sternum and ribs.

[I witnessed and reported a case in which aneurism of the innominate artery was suspected and in which ligation of the carotid artery was practiced as a last resort, following the use of iodide of potash, digitalis, and continued digital pressure for thirty-six hours and mechanical pressure for one hundred and twenty hours. The patient died immediately upon the ligation of the carotid artery. A post-mortem examination showed that the aneurism was one involving the arch of the aorta and that coagulation had resulted from the pressure, but not sufficient to occlude the vessel. J. McFadden Gaston.]

Aneurism probably arising from one of the pulmonary sinuses of Valsalva. Peculiar features noted: Development of the sac anterior and to the left of the sternum; the sac fills up a large portion of the upper half of the left thorax; absence of involvement of the vagus and recurrent laryngeal and of the sympathetic nerves; peculiar and unusual murmurs; absence of irregular and asynchronous action of the radial pulses; absence of tracheal tugging.

Points of unusual interest: 1. Two years since the first symptoms appeared; the patient has, during the greater part of the time, been able to be about on her feet, doing light work. 2. Almost entire absence of the usual pressure symptoms. 3. Remarkable result of the therapeutic measures: iodide of potassium, mercurial inunctions, and repeated venesection. 4. Decided benefit gained from venesection. On one occasion, at

least, the patient's life was undoubtedly saved by the prompt opening of a vein and the withdrawal of twenty-eight ounces of blood. J. B. Shober (Amer. Jour. Med. Sciences, Feb., '97).

Remarkable case of aneurism of one of the sinuses of Valsalva met with in a man, aged about 45, found dead. The aneurism bulged into the right auricle and ruptured at a point just above the attachment of the posterior tricuspid segment.

In 1840 Thurman collected 22 cases where aneurism of the aortic sinuses was present. Twenty further cases given. Cottell and Steele (Inter. Med. Mag., pp. 258-263, '97).

The situation of the aneurism with reference to the superior vena cava and subclavian vein causes various accidents. The aneurism may burst into the superior vena cava, or may compress it, causing engorgement of the vessels of the head and arm; or it may compress the subclavian vein, when the right arm is enlarged.

Case of a girl, 9 years old, who had had pertussis in infancy. At 6 years she had a second attack, which was very severe. At 4 years she had had vague pains, which were supposed to be rheumatic, and shortly afterward some cardiac disorder was recognized. At 7 years she had typhoid fever, and at 9 measles. She suffered from cough, which was occasionally brassy, and slight pain in the sternum, but there was no cyanosis, œdema, dyspnœa, or palpitation of the heart. There was tracheal tug, but pulsation of the abdominal aorta was not palpable. There was dullness from the base of the sternum to either side, and a loud, harsh murmur was heard loudest in the first right intercostal space close to the sternum. In addition two murmurs were heard at the apex. The author found in literature seventeen cases of aneurism of the thoracic aorta occurring before 20 years of age, and some cases of aneurism of the abdominal aorta, and of other arteries, the total number being sixty. Sex has little influence, and the termination is usually sudden death. Le Boutillier (Amer. Jour. Med. Sciences, May, 1903).

These aneurisms may affect the right recurrent laryngeal nerve; and also compress the inferior vena cava, which is followed by ascites and œdema of the feet.

Point in aortic aneurism emphasized of recent years: the comparatively frequent latency of aortic aneurism, the disease then giving rise to very few or indefinite symptoms. A paralysis of the left vocal cord may constitute the first means of recognizing the aneurism. Auscultation of the upper part of the left interscapular space may reveal an arterio-diastolic murmur not heard elsewhere, or there may be here, or in the neighborhood, a systolic murmur due to the beating of aneurismal sac on the left bronchus. Gerhardt (Deutsche med. Woch., June 10, '97).

The heart may be pushed down to the left.

Rupture into the pleura or superior vena cava is the usual cause of death, but this may be due to heart-failure or to external rupture.

Transverse Arch.—Three varieties of aneurism are observed in this location. In the first and most common form the aneurism is small and not visible externally. The growth is directed backward or downward and may involve the œsophagus, causing dysphagia. The trachea may also be pressed upon, giving rise to cough, which is often paroxysmal. The left recurrent laryngeal nerve may also be compressed as it passes around the arch of the aorta or a bronchus. In the latter case bronchiectasis, bronchorrhœa, and suppuration into the lung, not uncommonly the cause of death, may result.

The second variety of aneurism of this class is that in which the mass may project forward and simulate a large tumor. It may destroy the sternum and penetrate the opening thus created.

In the third class the aneurism may grow on both sides into the pleura between the sternum and vertebral column. This form may last for years. The carotid (radial pulse) may be affected by the involvement by the sac of the innominate artery, or more rarely the carotid and subclavian arteries.

Compression of the thoracic duct, an occasional complication, may finally induce inanition. When the compression includes the sympathetic nerve, there is, at first, dilatation of the pupil; this may be followed by paralysis, with contraction of the pupil. Pressure of the vertebræ may cause severe pain; of the œsophagus, dysphagia; of the lungs or bronchi, bronchiectasis, the retention of pulmonary secretions giving rise to fever.

Most are saccular; some are small and spring from the aorta just above the aortic ring. Another variety springs from the anterior and upper aspect of the aorta in the form of large tumors, or from the descending aorta and the lower surface of the arch, compressing the trachea or bronchi.

In intrathoracic aneurism clubbing of the fingers and incurving of the nails of one hand may also be observed, even when no venous engorgement is present.

Sudden death may be induced by rupture into the pleura or a small and latent aneurism bursting into the œsophagus. The spinal cord may be compressed and give rise to disorders of locomotion.

Differential Diagnosis.—When the aneurism is in the thorax, the conditions with which it may be confounded are:—

1. Violent throbbing of the arch through marked aortic insufficiency.

2. Displacement of the heart through the deformity caused by spinal curvature.

3. Pulsating pleurisy can be differentiated by means of a fine, hypodermic needle. In pulsating pleurisy the throbbing is usually wide-spread and diffuse; in aneurism there is a firm, heaving distension and a diastolic shock.

4. Tumors. In deep tumors the pain is likely to be more severe. Pressure phenomena are most common in aneurism. When the abdominal aorta is involved, neurotic pulsation of the latter should be suspected.

Almost none of the symptoms are due to the aneurism itself, but most are produced by the influence of the tumor upon neighboring structures. A certain amount of dull pain may be due to the distension of the sac-wall itself; but this is usually entirely overshadowed by that produced by alterations in parts in the neighborhood. For our diagnosis we must depend not so much upon the physical signs of an arterial tumor as upon those due to an abnormal growth of whatever nature.

The typical signs of aneurism may be said to be tumor, expansile pulsation, thrill, bruit, and shock. Tumor is frequently absent; expansile pulsation is, in many situations, impossible of detection; thrill is a very uncertain sign; bruit is as often absent as present; while shock, whether diastolic or systolic, is frequently absent. F. A. Packard (Mass. Med. Jour., Oct., '97).

Radioscopy is of value in the study of aneurisms of the arch of the aorta, but of little use in case the descending aorta is affected, as under the latter conditions the shadow of the heart overlies that of the aneurism. G. R. Murray (Practitioner, Feb., '98).

The fluoroscope in diagnosing aneurisms of the aorta. While aneurisms usually throw a shadow beside the heart, which can be seen to enlarge in all directions with each heart-beat, this must not, however, be regarded as pathognomonic. Case in which, although the shadow was well defined and the pulsation marked, necropsy showed carcinoma of the cardia with extreme dilatation of the œsophagus above, thus simulating aneurism. G. Kirchgaesser (Münchener med. Woch., May 8, 1900).

Case of aneurism of the aorta in which pain along the intercostal nerves, on both sides, with marked disturbances of sensibility,—*i.e.*, intercostal neuritis, due to pressure,—was the main symptom of the aneurism for months. Subjective symptoms were entirely absent. Frick (Wiener klin. Woch., June 20, 1901).

The diagnosis of aortic aneurism still remains, in obscure cases, a difficult one, and even the x-ray examination may be misleading. Attention called to the frequency with which, in aneurism of the arch, the left supraclavicular groove is obliterated or even bulges, and the left external jugular is obviously fuller than the right. The anatomical reason lies simply in the compression of the left innominate vein as a result of the dilated arch. A mediastinal tumor may have the same effect, but dilatation in cases of aortic insufficiency is apparently seldom sufficient to effect compression. Dorendorff (Deutsche med. Woch., Nov. 31, 1902).

Etiology. — Aortic aneurism is especially due to alcohol, syphilis, and overwork. Sudden muscular exertion may lacerate the media. The etiological factors of aneurisms in general may all be considered as capable of promoting aneurism of the aorta.

Treatment. — All methods should be aided by rest in bed and proper diet.

Potassium iodide given in doses from 10 to 20 grains thrice daily relieves pain, causes thickening and contraction of the sac, and lowers the blood-pressure. Pain may sometimes be relieved by anodyne plasters or embrocations, but morphine may be necessary in the final stages. Ice poultices, recommended by some to relieve pain, are liable to cause gangrene of the skin, owing to deficient circulation. Chloroform may be used in dyspnœa. Small, but repeated, venesections are highly recommended for the latter symptom.

Venesection—removal of from 27 to 30 ounces—followed by great relief from paroxysmal dyspnœa and from pain, lasting nine months in one case. One copious venesection recommended. Davison (Lancet, May 19, '94).

Three cases of thoracic aneurism treated by large doses of potassium iodide with excellent results. In two cases there was apparent recovery with disappearance of the pulsating tumor and the bruit. The third case was so far advanced that external hæmorrhage had taken place from the anterior wall of the aneurism; yet on 80 grains of potassium iodide three times a day marked improvement took place, the patient being enabled to return to business and to lead a quiet life. Failure in the treatment of aneurism with potassium iodide often results from the fact that the dose is too small. No result is obtained in bad cases until the dose is over 60 grains. Kingdon (Lancet, Aug. 22, 1903).

Tracheotomy may be useful when dyspnœa is due to bilateral abductor paralysis, but not when it is due to compression at the bifurcation, which is almost always the case.

Where external rupture of an aneurism is feared hemlock or lead plaster may be used as a support. (Ashhurst.)

Laceration of the media frequently occurs in the ascending portion of the arch previous to the occurrence of compensatory thickening. (Osler.)

Tuffnell's treatment of restricted diet and rest in bed has given satisfactory results.

If the milder methods do not succeed needling should be tried, aided by distal compression, when feasible, during the use of the needles; if this fail, distal ligation should be resorted to. (Nancrede.)

In treatment of aneurism of aortic arch following conclusions reached: 1. The remedy lies within the domain of surgery. 2. There are but two such methods at the present time to be considered: (*a*) obstruction of the right

subclavian and common carotid arteries; (*b*) introduction of wire or needles into the sac, with or without galvanism. 3. Either one or both of the operations should be applied in all cases after a thorough saturation with the iodides. 4. Ligation is attended by less danger, less mortality, greater and more permanent and universal benefit. B. Merrill Ricketts (Jour. Amer. Med. Assoc., Aug. 13, '98).

Discussion on treatment of aneurism of the aorta. Golubinin, of Moscow, had employed in 8 cases the method of treating aortic aneurisms by injection of gelatinized serum recommended by Lancereaux and Paulesco. The number of injections varied according to the case from 2 to 15. Of the 8 patients, 4 died in a short time and the other 4 were lost sight of; in 3 of the cases belonging to the latter group the injections produced no effect. In the remaining 1 they were followed by slight improvement in the subjective symptoms without modification of the objective signs. Golubinin had come to the conclusion that the method did not fulfill the expectations that had been founded on it. In the treatment of aortic aneurism. Huchard says it is a mistake to allow one's self to be hypnotized by the changes to be brought about in the content of the sac, —that is to say, in the blood,—and to take no account of the containing structure. The method of gelatinized injections, which is useful, although insufficient, is open to this criticism. To complete its action, especially in persons with large heart and increased arterial tension,—they are almost always at the same time subjects of Bright's disease,—medicaments should be chosen which diminish arterial tension, such as potassium iodide, trinitrin, nitrite of amyl, and especially tetranitrate of erythrol, or tetranitrol, which Huchard has now used for a considerable time and which, as compared with trinitrin, has the advantage of a more durable action. Moreover, an essential point is to supervise the diet not in regard to quantity, as in Valsalva's method, but in regard to quality. Meat, which holds too large a place in our food, contains toxins, which have an excessively powerful vasoconstrictor action. The best treatment of aortic aneurism is still absolute milk diet regularly adhered to. (Section of Therap., Inter. Congress of Med., 1900; Brit. Med. Jour., Oct. 13, 1900).

Remark on treatment of aneurism of the aorta by the insertion of a permanent wire and galvanism based on a report of 5 cases. A black varnish or lacquer makes the best insulation for the needle. The disposition of the wire in the lumen of the sac is an important factor in the amount and the effectiveness of the fibrin whipped out. A small quantity of wire possessing a good spring should be selected. Cure of the aneurism demands as complete contraction as possible of the sac-wall upon the clot formed at or soon after the operation. The wire should be of such amount and material as not to interfere seriously with this contraction. The corrosion of the wire by the electric current makes a rough surface very conducive to the rapid whipping out of fibrin. Within certain limits, the wire most easily corroded is to be preferred. The sac should never receive both poles, and the negative electrode should never be in the sac. Sepsis is an omnipresent danger. Another danger is that of the development and rupture of a secondary sac due to the rapid filling up of the main sac by coagulum, and the shunting of the blood-stream against a portion not receiving a special strain before. Thirty-nine per cent. of successful results reported in the 23 cases, including the author's 5, found in literature. G. L. Hunner (Johns Hopkins Hosp. Bull., Nov., 1900).

In these cases graduated exercise, baths, and the Schott method, with a suitable dietary, sometimes afford marked relief.

Case of aneurism of the aorta treated by mineral baths and graduated walking exercise, with a liberal nitrogenous dietary and free ingestion of fluids to eliminate uric acid, etc. After six weeks the patient could walk with comfort during three hours a day. A sciagraph showed that there was no increase in the size of the aneurism in spite of the exercise. Recurrence of the symptoms

promptly yielded to the same treatment. Bezly Thorne (Brit. Med. Jour., Mar. 6, '97).

In this form of aneurism favorable results are sometimes obtained by the introduction of foreign bodies.

In 1895 Dastre demonstrated that the injection of a solution of gelatin into the veins of a dog rendered the blood more coagulable. This discovery has recently been utilized in the treatment of aneurism of the first portion of the arch of the aorta.

Case of a man, aged 46 years, who had a large aneurism undoubtedly due to a malarial aortitis, which had eroded the second, third, and fourth right cartilages, the extremities of the corresponding ribs, and a large portion of the sternum. On the surface of the tumor there were patches of ecchymosis which were soft and depressible, and in the neighborhood of which the blood was directly in contact with the very thin skin. On January 20th 13 drachms of a 1-per-cent. sterilized solution of gelatin in a 0.1-per-cent. solution of sodium chloride was injected into the subcutaneous tissue of the left buttock. The solution was injected at a temperature of 98.4° F. There was a slight reaction following this injection. During the following days the tumor became somewhat diminished in volume and the pains completely disappeared; but soon the tumor returned to its former dimensions, the walls again became soft, and the intercostal pains returned. On February 10th a second injection of 5 ounces of a solution similar to that first employed was given. This solution was followed by results similar to those which followed the first injection, except that there was no reaction. Since that time twelve injections similar to the second have been made at intervals of from two to five days. The tumor diminished in volume (one inch in the vertical and one-half inch in the transverse diameter). It is very firm, and, although on palpation a pulsation can be felt, that pulsation is not expansile, but is transmitted from the aorta. The pain entirely disappeared. Lancereaux (Gaz. des Hôp., June 24, '97).

Case of aortic aneurism in which the tumor extended over the sternum, the sternal portions of the clavicles, and the whole anterior surface of the neck, its diameter being seven and one-half inches. Injections in the vicinity of the tumor of 75 minims of gelatin, suspended in 10 drachms of sterilized normal saline solution, were given every four days. Under this treatment its size has decreased, the hoarseness has disappeared, and the general condition is improved. Carl Beck (N. Y. Med. Jour., Apr. 15, '99).

Gelatin injections in aortic aneurism. The first indication is to eradicate, if possible, the cause. By increasing the coagulability of the blood the sac may now be obliterated. This is most efficiently accomplished by gelatin. Gelatin injections (15 grains of gelatin in 2½ drachms of sodium-chloride solution once a week) may then be resorted to. Remarkable results on personal case in which five weeks of this treatment practically freed the patient from symptoms both subjective and objective. In this case the iodides had produced no effect. N. Kalendern (Klin. therap. Woch., Jan. 28, 1900).

Case of very large aneurism of the ascending aorta, treated by gelatin and electrolysis. Coagulation of most of the contained blood occurred. The operation was comparatively painless except at the beginning. A few weeks later the patient had an attack of intermittent fever. Several large blebs formed near the sternal margin of the aneurism, which finally ulcerated and revealed necrosed fragments. The patient died suddenly from hæmorrhage, the blood pouring from the point of successful puncture. Autopsy showed evidences of recent coagulation. W. W. Johnston (Amer. Medicine, May 11, 1901).

Carotid Aneurism (in the cervical region).

Symptoms.—Aneurism of the carotid artery usually occurs where the common carotid bifurcates into the internal and external carotid arteries. On the right

side it most frequently appears where the artery springs from the innominate artery. Its special symptoms are dyspnœa, difficulty in swallowing, hoarseness, a brassy cough, vertigo, and tinnitus aurium.

Carotid aneurism first appears as a small tumor, which may grow very rapidly.

> Case of aneurism of the internal carotid following scarlet fever in a girl, aged 18 years, severe inflammation of the throat being a prominent symptom. A month after the onset the aneurism appeared in the left sterno-mastoid region, immediately below the mastoid. It was the size of a walnut, reducible, and pulsating energetically. On exploratory puncture with a Pravaz syringe blood was obtained. No treatment was employed. Gradual improvement took place, and the patient spontaneously recovered in three months. Lyot and Retit (Revue des Sciences Méd., July, '97).
>
> Case of aneurism of the internal carotid artery following tonsillar abscess in a girl 8 years old. The left tonsil and the wall of the pharynx were markedly protruded; this, with the enlarged submaxillary glands, closely resembled postpharyngeal abscess. The tumor, however, showed marked expansile pulsation, and aspiration brought away nothing but pure blood. During the opening of a tonsillar abscess the carotid artery had been wounded, causing the loss of a pint or more of blood. The child recovered and an aneurism gradually developed. The common carotid was ligated just below its bifurcation. The aneurism ceased and did not return. The clot in the sac, however, suppurated and was opened, and a discharge came from the left ear, which, however, finally disappeared. The throat returned to its normal size and complete recovery ensued. P. Wulff (Münchener med. Woch., May 15, 1900).

Differential Diagnosis. — At the root of the neck it is sometimes difficult to ascertain whether the carotid alone is involved. Aneurisms of the subclavian, the innominate, and the aortic arch may simulate those of the carotid when these are close to the clavicles.

Enlarged cervical glands may be taken for aneurism; but, as these are usually multiple and not endowed with powers of auto-expansion, their diagnosis is easily established. Cysts and vascular growths of the thyroid resemble aneurisms in some cases. Cysts in the cervical region are very rare, while any growth connected with the thyroid gland follows the movements of the latter during deglutition.

Abscess may be taken for aneurism, especially cold abscess, but the cachectic facies is different, and the growth, though pulsatile through the pressure upon the underlying large vessels, is not expansile. An ordinary abscess can easily be recognized by its characteristics, which differ entirely from those of aneurism.

Prognosis.—Spontaneous cure is rarely observed. The usual course of an aneurism is to progress until rupture into the pharynx or trachea or externally takes place. Some cases remain dormant for a long while, and suddenly undergo the process of development.

Treatment. — All methods should be supplemented by recumbency and diet. Proximal compression, when feasible, should always be tried, and, where the arterial coats are seriously diseased, should supersede ligation. Needling should supplement pressure when the case is progressing rapidly. Possibly it is advisable in all cases suitable for compression, and is certainly to be employed where this method fails in cases with highly atheromatous vessels. Proximal ligation, having been rendered much safer of late by the use of aseptic precautions, less-absorbent ligatures, and the avoidance of all injury to the arte-

rial walls by employing the stay-knot, is permissible when the arterial walls are relatively sound, until experience decides whether or not needling is clearly indicated. Since recurrence after proximal ligation almost certainly results from non-deposition of white thrombi and their maintenance in contact with the aneurismal wall from lack of proper changes of its lining, needling is clearly indicated. Where the location prevents proximal arrest of the blood-current, needling is the best operation; possibly distal compression — rarely feasible — might aid in the deposition of thrombi. For the reasons already given, although occasionally successful, the indications for the permanent introduction of such foreign bodies as wire, horse-hair, etc., into aneurismal sacs are so much better met by needling that such procedures had better not be adopted. The modern revival of the older method of extirpation of aneurisms should not be attempted for spontaneous cervical aneurisms. (Nancrede.)

Extirpation of an aneurism of the carotid may, however, be followed by good results, even when the common carotid is involved.

The treatment most generally employed, if there is room, is to tie the artery between the sac and the heart, and, if there is not room enough, beyond the sac. This may, however, be followed by embolism, cerebral softening, hemiplegia, syncope, or by secondary hæmorrhage or suppuration.

More than one-third of the deaths following ligation of the common carotid are due to subsequent cerebral disease.

Ligation of both common carotid arteries, at a year's interval; neither operation followed by brain symptoms. Gay (Boston Med. and Surg. Jour., Mar. 8, '94).

When both carotid arteries must be tied, it should not be done at the same time, as fatal coma has followed a simultaneous operation.

Gentle handling of cervical aneurisms recommended to avoid the dislodgment of coagula through the internal carotid. Case in which a rough manipulation was followed by immediate paralysis. Hulke (Inter. Med. Mag., Dec., '92).

Subclavian Aneurism.

Symptoms. — Aneurism of the subclavian attacks more especially the third portion of the artery, appearing as an elongated tumor beneath the clavicular insertion of the sterno-cleido-mastoid.

Extirpated aneurism of the external carotid. (*Delagénière.*)
(Archives Provinciales de Chirurgie.)

The special signs of subclavian aneurism are a varicose condition of the jugular veins, a retarded pulse at the wrist, œdema of the arm and hand, pain in the nerves of the brachial plexus, and, if the aneurism is on the right side, a brassy cough from irritation of the recurrent laryngeal nerve. Two-fifths of the deaths following ligation of the third part of the subclavian are due to intrathoracic inflammation.

Diagnosis. — Aneurism of the subclavian artery in its third portion is to be distinguished from carotid aneurism. In the former the pulse at the wrist is

found delayed when compared to the pulsation of the carotids.

When both the carotid and radial pulse on the right side are delayed as compared to the left carotid artery, aneurism of the innominate artery is to be suspected.

Treatment. — Medical treatment of subclavian aneurism should precede all other methods. Ligature of the innominate, when supplemented with simultaneous and consecutive ligature of the associated contiguous arteries, or by other expedients equally well intended to aid the cure, is worthy of favorable consideration. (J. D. Bryant.)

Pressure applied by the finger between the aneurism and the heart, supplemented with general measures, has been tried in cases in which the tumor was small. This procedure is not easy, however, on account of the anatomical constitution of the region and has been replaced by direct pressure upon the sac proper.

When compression is unsuccessful the artery may be tied beyond the aneurism. Ligation between the latter and the heart has rarely succeeded.

Method of controlling the circulation in the upper extremity by elastic compression. A wooden pad is placed over subclavian and held in place by the rubber bandage of the Esmarch apparatus; the bandage carried from the chest over the back and then alternately between the thighs and under the opposite axilla. W. W. Keen (Med. and Surg. Reporter, June 27, '91).

Successful ligation of the first portion of the left subclavian artery and excision of a large subclavio-axillary aneurism, probably the only successful case of this kind and the first one of complete extirpation of a subclavio-axillary aneurism. Halsted (Johns Hopkins Hospital Bulletin, July, Aug., '92).

Study of one hundred and fifteen operated cases of subclavian aneurisms. Deductions as to treatment: Strict asepsis the sheet-anchor. The best plan is to ligate the first portion of the subclavian with a double or, better, triple, noncontiguous, absorbable ligature, without rupturing the coats. When it is decided to ligate the subclavian and the common carotid in one operation, it is best to first ligate the subclavian. In idiopathic aneurisms the defective general condition of the patient should be borne in mind. Souchon (Annals of Surg., Nov., '95).

Aneurism of the left subclavian artery in which twenty feet of gold wire was introduced into the sac through a hollow needle, and a constant current, gradually increasing from 1 to 80 milliampères, was employed for about one hundred and ten minutes. The pulsation and size of the tumor temporarily decreased and afterward increased, and death occurred on the twentieth day after operation, due to exhaustion produced by long-continued pain, and hastened by the formation of a thrombus in the left common carotid artery, caused by the pressure of the aneurism. The necropsy showed a cocoanut-shaped aneurism involving the entire length of the artery. Its cavity was occupied in large part by a clot in varying stages of organization, through which the wire was well distributed. This operation is worthy of trial when medical treatment fails. The percentage of success will be greatly increased if the operation be not performed as a last resort. Daland (Penna. Med. Jour., Dec., 1903).

Axillary Aneurism.

A peculiarity of this form is its rapid growth. Being surrounded by lax tissues, it develops very quickly and is soon of considerable size. The same anatomical feature causes the sac to be easily inflamed, its location tending to assist this by the exposure to traumatism, pressure, etc.

Pain is usually a prominent symptom, owing to pressure on the nerves of the brachial plexus. Œdema of the forearm usually follows the venous obstruction induced by pressure of the aneurism on the venous trunks. The pulse at the

wrist is slower than that of the opposite side.

An axillary aneurism may compress the lung, causing dry pleurisy or hyperplastic pneumonia, or may erode the ribs. It may invade the shoulder-joint, interfere with the motion of the arm, and cause ankylosis.

Traumatic axillary aneurisms are caused by a wound, an attempt to reduce an old dislocation, etc.

Etiology. — Aneurism of the axillary artery is sometimes traumatic. At other times it may be due to elongation of the artery by too free motion of the shoulder-joint, or to stretching during the reduction of an old dislocation, especially when the vessels are atheromatous.

> Case of axillary traumatic aneurism caused by the jamming of a pair of scissors up into the axilla, making a punctured wound about 1 inch in depth. The aneurism consolidated spontaneously and was almost entirely absorbed. This result was probably induced by elevation of the arm, with the patient in the recumbent position. Willett (Practitioner, Dec., '98).

Prognosis.—Spontaneous cure of these aneurisms is very rare. The sac, if allowed to do so, rapidly becomes larger and ruptures into the surrounding cellular tissue, the shoulder-joint, or the thorax.

Treatment.—Compression of the third portion of the subclavian may be first tried, with or without an elastic bandage applied to the arm. Compression is usually very painful. Should these methods fail, the third portion of the subclavian may be tied.

The most satisfactory treatment in general is to ligate the subclavian as far away as possible, dividing the scalenus anticus. When the incision involves considerable tissue the phrenic nerve should be watched for, and pushed aside if met. Collateral branches of the artery should also be tied to diminish the risk of secondary hæmorrhage.

> Cases of axillary aneurism, with successful ligation of subclavian artery. Neugebauer (Centralb. für Chi., Aug. 17, '95); Horwitz (Ther. Gaz., May 15, '95); W. E. Waters (Medical Record, May 25, '95).

The treatment of traumatic aneurism should consist in arresting the circulation by pressure on the third portion of the subclavian, opening the sac, and removing its contents. The wound in the artery should then be found and the artery divided at that point, both extremities being tied.

Brachial.

Brachial aneurism is usually traumatic in origin. Venesection, carelessly performed, occasionally causes aneurismal varix or varicose aneurism at the bend of the elbow.

> Aneurism half the size of an orange in the bend of the elbow, subsequent to venesection, cured by ligature of the brachial artery in middle third. Gallo (Le Dauphiné Méd., Mar., '94).
>
> Case diagnosed as a neuroma of median nerve found, on exposing swelling, to be a cured traumatic aneurism of the brachial artery. On account of excruciating pain artery cut above and below aneurism and sac dissected out. Bland Sutton (Med. Press and Circular, Sept. 26, '94).

Idiopathic brachial aneurism may be treated by Hunter's method, by the modified method of Antyllus, or by compression. In either of these, however, gangrene of the forearm is a possibility. When this complication occurs, amputation becomes necessary.

Abdominal Aorta.

Symptoms.—Aneurism of the abdominal aorta is uncommon, as compared to that of the thoracic aorta. It usually occurs near the cœliac axis, where it may form a fusiform, sacculated, or

multiple tumor; this may project backward, and either erode the vertebræ, causing subsequent numbness and tingling in the legs, which may be followed by paraplegia, or it may burst into the pleura.

This form of aneurism, however, usually projects forward either in the middle line of the abdomen or somewhat to the left. If it is located high up, and under the pillar of the diaphragm, it may be beyond the reach of the hand in palpation.

There usually are disorders of digestion, especially vomiting and pain, the latter frequently simulating cardialgia. It may be located either in the back or resemble girdle pains, passing around the sides to the back.

> Case of aneurism of the abdominal aorta, with symptoms of renal colic. Cheadle (Lancet, Nov. 20, '97).

A distinct tumor is generally visible in the epigastric region. Locally, pulsation may be detected, while a thrill may frequently be observed when the hand is applied over it.

Palpation usually reveals the presence of a definite tumor, showing a strong expansile effort; the pulsations may be double in character when the aneurism is large and brought in contact with the pericardium.

Percussion may elicit a certain amount of dullness, usually intermingling with the dullness of the left lobe of the liver.

Auscultation will usually reveal a systolic murmur, and at times a very soft diastolic murmur. The former is frequently best heard by auscultating behind, near the spinal column.

Differential Diagnosis.—A throbbing aorta is frequently mistaken for an aneurism. An abdominal aneurism should not be declared present unless a definite expansile, pulsatile, and graspable tumor can be felt, notwithstanding the presence of a forcible pulsation, a thrill, or a systolic murmur.

Tumors of the left lobe of the liver, of the pancreas, and of the pylorus may all be influenced by the movement of the aorta and suggest aneurism, but there is no expansile action in tumors, and, if the patient be placed in the knee-elbow position, the pulsation will usually not be felt, owing to the tumor falling forward by its weight and thus being no longer in contact with the aorta.

Prognosis.—The prognosis is unfavorable, although a few cases of spontaneous recovery have been observed.

Death may be due to compression of the spinal cord; paraplegia and its results; to embolism of the superior mesenteric artery followed by infarction of the bowels; to the aneurism bursting into the retroperitoneal tissues, the peritoneum, or the intestine, usually the duodenum, or into the pleura; or finally to the abdominal aorta becoming obliterated by clots. (Osler.)

Treatment. — The treatment of abdominal aneurism is the same as that of aneurism of the thoracic aorta.

Pressure of the aorta above the sac has been successfully tried in a case where the aneurism was localized low down; but it should be remembered that traumatism of the sac has caused death in similar cases. Should this treatment be selected the pressure should be continued for many hours, under chloroform.

> Case of aneurism of the abdominal aorta causing death by rupture into the stomach. Great danger of the administration of ergot in aneurisms, greatest in cases where the walls of the sac were more than ordinarily attenuated, or where the tendency to atheroma was marked. Ridley-Bailey (Brit. Med. Jour., July 11, '91).

The introduction of gold or silver wire,

with or without the assistance of electricity, have been used with success.

Case in which aneurism of abdominal aorta was exposed by a free abdominal incision, and a hollow, gold-tipped needle inserted into the sac. Through this was passed eight and one-half feet of No. 30 gold wire, which was connected with the positive pole of the battery; a clay plate placed under the buttocks was connected with the negative pole. The current was gradually increased to 70 milliampères during half an hour. The pulsation in the tumor lessened, but the patient became collapsed and cyanosed, reviving, however, later under stimulant treatment. The wire was left in the sac, and the wound closed. Patient died six months later from some other affection, but there was no recurrence of the aneurism. Of 11 other cases treated in this way by other surgeons, 4 resulted in apparent cure and 6 improved. W. H. Noble (Phila. Med. Jour., June 25, '98).

Aneurism of the abdominal aorta successfully treated by introduction of silver wire into the sac. A trocar was introduced into the sac, and not much blood issued. Five feet of silver wire were introduced without difficulty. The puncture was secured with a silk ligature. There was some vomiting and a good deal of restlessness after the operation. A month later consolidation was occurring. The after-progress was uneventful. There is at the present time a hard mass in the middle line much smaller than before the operation, and the thrill and bruit have disappeared. Her health was excellent. John Langton (Treatment, May 25, '99).

Case of ligature of the abdominal aorta just below the diaphragm in aneurism of the upper part of that vessel, the patient surviving forty-eight days. The patient was a laboring man, 52 years old, probably with a syphilitic history, for whom it was first proposed to employ wiring and electrolysis, should an exploratory section show its feasibility. The patient, however, left the hospital, only to return five days later with the symptoms of a severe internal hæmorrhage. An exploratory section revealed an enormous retroperitoneal hæmatoma communicating with the aneurism, and the incision was closed. Repeated injections of a 2-per-cent. solution of gelatin were given, and, the patient's condition improving, a second operation was performed thirteen days later. The omentum was torn through, and with a long-handled pedicle needle four strands of floss silk were carried from left to right under the aorta and near the diaphragm. The silk was disengaged from the eye of the needle with great difficulty and was tied. Immediately the head, face, and neck became livid, but this lividity subsided after a few hours. The aneurism shrunk to one-half its original size within a few minutes. Seven days later the femorals were found to be pulsating slightly, and the legs had regained their warmth. The amount of urine excreted after the operation gradually reached the usual pre-operative amount. Forty-eight days after the operation the patient died suddenly from hæmorrhage due to ulceration of the aorta at the seat of ligation. Personal opinion that this result will almost certainly follow in any case of ligation of the aorta in which death does not result from other causes, and a removable clamp (devised by the author) to be placed upon the aorta through an abdominal incision and capable of being loosened, tightened, or removed, at will, becomes necessary. Keen (Amer. Jour. of Med. Sciences, Sept., 1900).

The case of an abdominal aortic aneurism in a woman noted. There was a systolic "bruit" over the area, but the heart was normal. Gelatin was given per mouth. Twenty grammes dissolved in normal saline were given daily. The recumbent position was maintained and ice-bags continuously applied to the abdomen. Two months afterward the tumor was less resistant and smaller. The ice-bag was then used during two hours daily, and the gelatin given every other day. Four weeks later the aneurism could only be felt as a slight thickening. The ice applications were now suspended, and a solution of ichthyol in $CHCl_3$ and camphor spirit was rubbed over the painful places. The gelatin was continued for four weeks, and the patient

allowed to gradually resume ordinary duties. Buchholz (Norsk Mag. f. Laegevidensk., p. 185, 1900).

Iliac Aneurism.

An aneurism may form on either the common, internal, or external iliac arteries or one of their branches, and be, as in other regions, idiopathic or traumatic. In the latter case, however, the external iliac is almost always the portion involved.

Symptoms.—The enlargement appears as a circumscribed swelling in the line of the vessel, presenting the characteristic expansive pulsation and bruit along its course. If the genito-crural is pressed upon, pain may be a prominent feature of the case. Owing to the ease with which the surrounding organs may gradually be displaced, however, the aneurism attains a large size before it is discovered. Œdema and gangrene sometimes result from the pressure induced on venous trunks. If left to itself an iliac aneurism usually ruptures.

Differential Diagnosis.—Enlarged glands near Poupart's ligament may simulate an iliac aneurism. The glands are not pulsatile and cannot be emptied by pressure, while no bruit can be detected. Tumors and abscesses may be differentiated in the same way.

Treatment.—Aneurism of the *common iliac* artery is best treated by compression above the aneurism, as little as possible over the sac. A mortality of almost 75 per cent. is found as a result of ligation of the common iliac for aneurism.

If the aneurism be one of the *internal iliac* and idiopathic, pressure may be applied above it, and, in non-success, coagulating injections, or even ligation by a median laparotomy may be resorted to. If the aneurism is traumatic, the artery should be compressed above the aneurism, the sac incised, and the artery tied above and below the wound.

When dealing with the *external iliac* artery and the aneurism is idiopathic, compression should be first tried, followed in case of failure by ligation above the sac. This operation may be performed by a median laparotomy. The modified operation of Antyllus should be used if the aneurism is traumatic.

Case of successful extirpation of an aneurism of the right external iliac artery, occupying whole right iliac fossa and as large as the head of a child at term. Recovery uneventful, and patient following his occupation as a clown. Quénu (Le Bull. Méd., Dec., '94).

Case of large ilio-femoral aneurism. Ligation of external iliac artery. Patient up by the forty-seventh day. Three months later aneurism in opposite groin. Operation repeated; recovery much more rapid than on first occasion, collateral circulation being established more promptly. Patient a carpenter. Makins (Brit. Med. Jour., Nov. 30, '95).

Case in which transperitoneal ligation of the external iliac artery for femoral aneurism was performed with subsequent dissection of the sac. Recovery, but with complete paralysis of sensation over the anterior aspect of the thigh and inability to extend the leg on the thigh, probably due to section of some branches of the anterior spinal nerve while laying the sac open. N. P. Dandridge (Med. News, Apr. 3, '97).

Two cases of ligature of the external iliac artery for aneurism by the transperitoneal method. The transperitoneal operation has many advantages over the older operation, provided strict cleanliness is maintained. In both cases the ordinary operation would have been difficult, if not impossible, owing to the position of the swelling. W. H. Brown (Lancet, Oct. 23, '97).

The following conclusions offered as fundamental rules to be observed in the treatment of ilio-femoral aneurism: Whenever possible, compression should be given a trial before resort to more

severe measure. If compression fails, operative procedures are then indicated, and, when feasible, total extirpation of the sac should be chosen as the surest. These rules are especially applicable to ilio-femoral aneurism, but they are equally so to aneurisms of other portions of the body, if they are so situated as to allow of operative treatment. F. Schops (Wiener klin. Woch., Nov. 24, '98).

Case of aneurism of uterine artery cured by ligation of internal iliac artery. Patient was originally operated on for a pelvic abscess, which was opened through the vagina. The incision was followed by copious venous hæmorrhage. On examination there was found "a softly elastic, strongly pulsating, and thrilling tumor of about the size of a hen's egg, projecting into the left vaginal vault, close to the cervix and extending slightly down on the left vaginal wall." An incision was made in the left semilunar line and the internal iliac artery was isolated and tied. Pulsation, all but a slight transmitted movement, entirely stopped in aneurism and the patient made a good recovery. In order to doubly insure a cure galvanopuncture was practiced twice, with noticeable benefit. Paul F. Mundé (Med. Rec., Dec. 31, '98).

Femoral Aneurism.

Symptoms.—The femoral artery is frequently the seat of traumatic aneurism on account of its exposed position. It may involve the common, the superficial, or the deep. It is generally sacculated. In some cases it is fusiform or flattened, as in Hunter's canal.

Differential Diagnosis.—The difficulty here lies in recognizing whether the dilatation is on the superficial or the deep branch, the other characters peculiar to an aneurism being easily determined. The superficial branch is that most frequently affected, and the arterial pulsations below are more affected by it than by an aneurism of the superficial branch. The bruit of aneurism in cases where the femoral or popliteal artery is the seat of the lesion may frequently be made more distinct by placing the patient in the recumbent position and elevating the limb.

Case of multiple aneurism. *No.* 1, "Inguinal" aneurism; *No.* 2, Femoral aneurism; *No.* 3, Small aneurism, which had not been discovered during the patient's life; *No.* 4, Popliteal aneurism, which ruptured; *A*, Orifice of femoral artery; *B*, Inferior orifice of same; *C*, Continuation of popliteal; *E*, Aneurismal sac. (*Monro.*)

Case of double aneurism of left thigh: one, the size of an egg, at Scarpa's triangle; the other, as large as a cocoa-nut, at the opening through the abductor

magnus. Superficial femoral ligated in middle of Scarpa's triangle, suppuration and two secondary hæmorrhages ensuing; wound enlarged and bleeding ends tied. Only one case on record of cure of double aneurism of superficial femoral artery by operative procedure. Souchon (N. Y. Med. Jour., Nov. 2, '95).

Treatment.—In idiopathic aneurism of this artery digital or instrumental compression above the sac is to be preferred. If this proves unsuccessful, ligation is to be resorted to. If the aneurism is in Hunter's canal, the artery should be ligated above; if it is in Scarpa's triangle, ligation of the common femoral gives the best results, although ligation of the external iliac is usually preferred, owing to the absence of branches where the ligature is usually applied.

The favorable statistics of the last decade may be greatly increased by adoption of this method of suture: an obliteration of the sac, instead of the classical ligation of the arteries, with or without extirpation; the closure of the arterial orifice, supplying the sac, whether single or multiple, by sutures; and within the sac simplified technique of the other operation. A favorable case—namely: saccular aneurism, with one orifice into the trunk is best. It is possible, by these sutures, to close the lumen without narrowing the main channel. In fusiform, traumatic aneurisms, and in all with a healthy, friable sac, lost continuity of the arteries may be renewed by building a new channel and connecting the main orifices of communication. The fear that atheroma and degeneration will interfere with healing has been exaggerated, especially since it has been shown that amputations in aged patients with sclerosed arteries may well succeed. The failure and danger of the old operation of Antyllus lie in the fact that ligation of the main artery, above and below the sac, will not always control the bleeding from collateral vessels opening into the aneurism, or into the main trunk between the arteries of the sac and the seat of ligation. The cutting of the sac away has the danger of interfering with collateral circulation. The operation of Antyllus, moreover, leaves the sac as an open cavity in the bottom of the wound, which heals by granulation, and induces infection, suppuration, and secondary hæmorrhage. All these difficulties are increased by the extirpation. R. Matas (Annals of Surgery, Feb., 1903).

In traumatic aneurism of the femoral the artery should be compressed on the edge of the pelvis by means of a tourniquet, the sac opened, and both ends of the divided artery tied.

Aneurism in Scarpa's triangle, in which instrumental compression above was employed for eighteen days, but had to be abandoned on account of the irritation of the skin which it caused. The aneurism gradually diminished in size and recovery followed. Molloy (Med. and Surg. Reporter, Apr. 22, '93).

Case of extirpation of a femoral aneurism, in a little girl of 11, extending from near Poupart's ligament to the lower part of Hunter's canal; it had been growing for fifteen months, and was not attributable to injury. The main trunk was first secured above the sac, and the whole mass enucleated; thirty-five dilated arterial twigs required ligature, and about five and a half inches of the femoral vein were also removed. The patient made a good recovery. Heurtaux (Bull. et Mém. de la Soc. de Chir., Nos. 9, 10, '95).

Two cases of femoral aneurism treated by excision. The vessel is ligated at its end instead of in its continuity and by removal of the sac. Provision is made against relapse through diseased or injured vessel, while the presence of more branches for recurrent circulation is insured. The first case was still well three years after the last operation. The second case died the second day from pulmonary congestion and œdema. G. R. Fowler (Med. Record, Mar. 23, 1901).

Popliteal Aneurism.

The popliteal artery being peculiarly liable to atheroma, it is the most com-

mon seat of aneurism after the aorta. Flexion and extension of the knee, if exaggerated but slightly when the vessel is diseased, act as exciting causes. The aneurism sometimes develops in this region without any apparent mechanical cause, and may present itself on either side. It usually grows posteriorly, rapidly penetrating the surrounding alveolar tissue and assuming large proportions. At other times it forms anteriorly, and presses against the bone or the posterior ligaments. Supported by these hard surfaces its growth is much slower.

Case of diffuse popliteal aneurism caused by an exostosis due to ossification of the tendon of the adductor magnus muscle. Similar case reported by Boling quoted in which rupture of the artery was caused by two epiphyseal exostoses. Terrier and Hartmann (London Lancet, May 20, '93).

Symptoms. — Although a sudden pain may reveal the presence of the aneurism, rheumatism of the knee is the usual complaint at the start. The joint then becomes weak and stiff, and examination finally reveals a growing tumor, presenting all the characteristics already described: expansive pulsations and bruit extending down the leg. The aneurismal tumor can usually be emptied, but in some cases all the subjective symptoms have to be very carefully sought after to be discovered. The tibial pulses usually show a marked difference. Complications frequently followed popliteal aneurism. Posteriorly, it may compress the veins and cause œdema, or give rise to severe neuralgia by pressing on the popliteal nerve anteriorly; synovitis may be induced, causing severe pain.

Case of pulsating tumor of the popliteal space simulating aneurism; illustrates importance of using exploring-needle in deep-seated fluctuating tumors. Marmaduke Shield (London Lancet, Oct. 6, '94).

Case of popliteal aneurism showing, as only symptom, cramp-like pain in the leg. J. Hutchinson, Jr. (Med. Press and Circ., Oct. 16, '95).

Differential Diagnosis.—Arterial hæmatoma presents the characteristics of popliteal aneurism even when no trauma is found. The bruit may be present, but the pulsation along the course of the vessel is weaker. Osteosarcoma, glandular enlargements, abscess, cysts, may also simulate a popliteal aneurism, but the expansile nature of the latter, and the possibility of emptying the sac, make it impossible to readily establish the nature of the case.

When the femoral artery above does not feel rigid, the aneurism is not due to atheroma and there is no atheromatous degeneration in the vicinity of the sac. Billroth (Wiener klin. Woch., No. 50, '93).

Prognosis.—Popliteal aneurisms occasionally undergo spontaneous cure. Usually, however, it progresses more or less rapidly according to its location; begins to leak; and finally ruptures into the surrounding cellular tissue, the blood extending along the tissues of the leg. The popliteal space becomes at once greatly distended. Considerable pain and faintness are experienced. The typical local symptoms do not cease, however, although considerably reduced in intensity. The limb below becomes livid and cold, and gangrene soon follows, if an inflammatory process does not come on. In the latter there is redness of the skin, local œdema, and severe pain. Suppuration of the joint is then probable.

[Two cases of this kind witnessed by me were cured by means of the iodide of potassium and compression. Both patients are now strong and healthy. J. McFadden Gaston.]

Treatment. — If there is evidence of atheroma digital compression should be preferred, provided there is no fear of impending rupture. Esmarch's bandage may also be employed. Flexion is useful if the aneurism is small. If these fail, ligation of the femoral artery at the apex of Scarpa's triangle gives the best results. The limb should be carefully wrapped in cotton wadding and raised somewhat. This is especially indicated when the sac is large, if it is inflamed, when leaking has begun, or when, through pressure on the popliteal vein, there is œdema of the foot.

Amputation is indicated when gangrene follows ligature, when the sac has ruptured, or if there is caries of the osseous tissues or suppuration around the sac.

Case in which total extirpation of the sac was followed by speedy recovery. Statistics of forty cases confirming this opinion, twenty-eight being cases of arterial aneurism and twelve arteriovenous. Kubler (Beiträge zur klin. Chi., B. 9, H. 1, '92).

Case of bilateral popliteal aneurism; sacs extirpated in two sittings with complete success. Ten cases of this affection reported, with nine recoveries and one death from sepsis. Schmidt (Archiv f. klin. Chi., vol. xliv, p. 809).

Popliteal aneurisms, if not too large, permit of the radical operation. The portion of the artery within the aneurismal sac is denuded and its walls are softened. Secondary hæmorrhage is likely to follow ligation at this point. The ligature should be applied outside of the sac or at a distance from the opening in the wall of the artery into the sac. Primary union of the walls of the sac is not to be expected. The inner portion of the sac becomes detached by necrosis. Extirpation of the wall of the sac is not necessary. The wound should not be entirely closed by sutures: the cavity should be loosely packed with iodoform gauze. In the after-treatment iodoform-and-glycerin emulsion is recommended. The cavity heals without trouble. Billroth (Wiener klin. Woch., No. 50, '93).

Three cases successfully treated by ligation of the femoral artery after compression and flexion had been tried without success. Leutaigne (Dublin Jour. of Med. Sci., July, '94).

Case of double popliteal aneurism treated by compression; three months later both sacs consolidated. Iodide of potassium, administered from the start, still continued. Golding-Bird (Brit. Med. Jour., Jan. 12, '95).

Case of popliteal aneurism cured by forced flexion of the knee. Treatment begun by half-flexion, which is much less painful. Alessandro (Riforma Medica, p. 5, '95).

Hypodermic injections of ergotin in aneurism recommended, the following mixture being employed:—

℞ Ergotin (Bonjean), 40 grains.
Spiritus vini rectificati, 80 minims.
Glycerini, 80 minims.

M. et ft. sol. Inject 3 centigrammes under the skin over the tumor. Langenbeck (Phila. Med. Jour., Feb. 14, 1903).

Traumatic Aneurism.

Traumatic aneurism is not due, like other aneurisms, to an anterior pathological condition of the artery-wall, but to a direct injury to the vessel, resulting in an arterial hæmatoma.

Traumatic aneurism may be caused by a shot or stab wound of an artery, by which the blood is extravasated into the neighboring cellular tissue, until it is arrested. There are three varieties of traumatic aneurism. The true traumatic aneurism is the form in which the artery, generally a large one, has received a punctured wound, which has healed and the cicatrix afterward yields. In this case the external coat of the artery and its sheath form a true sac.

A circumscribed traumatic aneurism is a variety wherein condensation of the surrounding cellular tissue has formed an adventitious sac for the blood. Circumscribed traumatic aneurism is usu-

ally due to punctured wounds of small arteries.

A diffused traumatic aneurism may be caused in three ways: (1) by healing of the cutaneous wound before the arterial wound heals; (2) by a subcutaneous injury to the artery without a skin wound; (3) later on, due to a bruise caused by a projectile or instrument, the bruised spot yielding when the remainder of the injury was healed.

A diffused traumatic aneurism should not be considered an aneurism; it is, in reality, but a collection of arterial blood in the tissues, not in communication with the exterior, like an ordinary wounded artery.

Protrusion of the inner coats of an artery through a wound of the outer coat is called a hernial aneurism. It is exceedingly uncommon.

Diagnosis. — That a traumatic aneurism may cause an abscess should be borne in mind; on the other hand, an uncomplicated traumatic aneurism may resemble an abscess. A positive diagnosis may be arrived at by the history of the case, and by withdrawing some of the contents with an asepticized hypodermic needle. Pus will be found if an abscess is present, and fluid blood if an aneurism.

Treatment. — The treatment of traumatic aneurism varies according to its location. It should be treated like a primary wound of an artery.

Where possible, as on a limb, an Esmarch bandage should be applied, the injured artery exposed by incision, completely divided. Both ends of the vessel are then tied. Every effort should be made to obtain primary union.

When the aneurism is located in a region where Esmarch's bandage cannot be used, as on the neck, the tumor should be exposed, and an opening made just large enough to introduce one finger, which, guided by the current of warm arterial blood, should be carried to the artery leading to the aneurism.

> Six cases in which aneurism of the arch of the aorta and of the base of the neck by the simultaneous ligation of the right carotid and subclavian arteries. But one death occurred: due to hemiplegia. In this case the arteries on the left side were not permeable, and so could not furnish blood to the brain. Thrombosis occurred. Ligation of the right carotid should never be performed when the left carotid and its branches no longer pulsate.
>
> The operation is not dangerous, provided a completely aseptic ligature is used. Blacque and A. Guinard (Ann. Mal. de l'Or., Nov., '96).
>
> Traumatic aneurism of the ulnar artery in the palm cured by tying the ulnar artery above the wrist. William Robertson (Brit. Med. Jour., Dec. 4, '97).
>
> Two cases of traumatic aneurism of the radial artery, treated by excision of the sac. Recovery. Elevation of the limb, combined with pressure on the sac, will sometimes effect a cure, but at best it is tedious in its application and uncertain in its results. Simple ligation of the vessel above and below the sac is more likely to prove successful. Excision effectually cures the disease, and is easily performed if the sac be of small size. Non-removal of the tourniquet, until the dressing and bandaging of the wound are completed, is a valuable detail. J. E. Platt (Med. Chronicle, Dec., '97).

Cirsoid Aneurism.

As compared to the forms of aneurism already described, this variety is very rarely met with. It should be classed with tumors, being, in reality, an arterial angioma.

Varieties. — Where a single vessel is involved, it is usually called an *arterial varix*; when a number of vessels are included in the mass, it is termed *cirsoid aneurism*; and, when the surrounding veins and capillaries are also dilated, the

name *aneurism by anastomosis* is applied to the irregular mass thus formed.

Symptoms. — Although cirsoid aneurisms may be met with in any part of the body, their site of predilection is the head especially, and more particularly the temporo-parietal region. The hands come next in the order of frequency. A cirsoid aneurism appears as an irregularly-shaped, bluish, and flattened mass of dilated blood-vessels, twisted inextricably together, from which project ampullæ, or bags. The skin over this is extremely thin, soft, and doughy to the touch, and is in imminent danger of rupture. Manual examination shows that it is connected with the arterial system, synchronous pulsation with the heart being evident. Its temperature is generally higher than that of the surface of the body, owing to the increased rapidity of the circulation through the tortuous aneurismal channels. It is easily emptied by pressure, but immediately fills as soon as released. A distinct thrill may generally be heard over it, which can be traced along its branches. It does not give rise to pain unless a nerve is involved in the absorptive process which cirsoid aneurisms give rise to in the surrounding structures. To this process is due the grooves found in bone underlying them and the thinness of the skin covering them.

Diagnosis. — When the discoloration and the general outline of the growth present does not at once establish its identity, a true aneurism may be simulated. True aneurism, however, is usually found upon an artery of considerable size, such as the carotid, the tracheal, and the popliteal, and does not yield so readily to pressure. The bosselated outline of cirsoid is replaced by a regular globular mass. The peculiar doughy sensation communicated to the hand during palpation is peculiar to cirsoid growths. Again, these are habitually situated in the extremities where medium or small arteries are to be found.

Pathology.—Cirsoid aneurisms usually occur as the result of traumatism. This is thought to give rise to paralysis of the vasomotor nerves supplying the region affected, and thus allowing the blood-vessels to be dilated. It has been known to start from a nævus, and it has been traced to an arteritis. In the majority of cases, however, its origin cannot be ascertained. As already stated, it belongs more properly to true tumors, and should be termed, according to Tillmann, "angioma arteriate racemosa."

> Cirsoid aneurisms believed to be due to arteritis, which weakens the vessel-walls and allows their dilatation. Arteritis explains all cases of cirsoid aneurism following an injury; those following nævi can be explained by a congenital defect of nutrition of the walls of the vessels. J. L. Reverdin (Rev. Méd. de la Suisse, Feb. 20, '98).

Cirsoid aneurism is most frequently found on the scalp and face, but it may likewise be found in the tongue, extremities, internal viscera, and bones.

Prognosis.—Although a cirsoid aneurism may not grow or change for many years, it may also steadily develop in size and spread by invading the vessels of the surrounding tissues. The thinness of the overlying skin presents constant danger, and rupture of one of the ampullæ may give rise to uncontrollable hæmorrhage.

Treatment. — Removal by excision is, by far, the best procedure to use, with complete arrest of the hæmorrhage by ligation of the afferent and efferent vessels. Among the other measures recommended have been ligation of the various afferent arteries, coagulation of the blood by means of various injections, the galvanocautery, electropuncture, and acu-

pressure. But none of these afford satisfactory results in the great majority of cases. In multiple cirsoid of the hand or other extremities, amputation sometimes becomes necessary.

Case of extensive cirsoid aneurism of the scalp, cured by multiple ligatures. Mynter (Annals of Surg., Feb., '90).

Case of cirsoid aneurism with ligature of the common carotid artery. Decided improvement, notwithstanding heavy work. W. D. Hamilton (N. Y. Med. Jour., Nov. 3, '94).

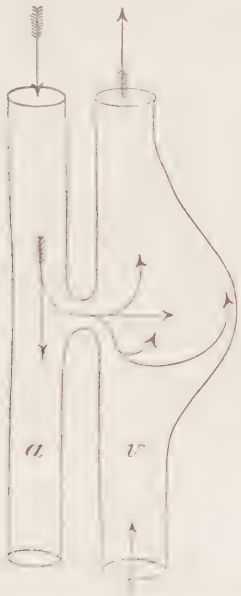


Fig. 1.—Diagram of aneurismal varix. *a*, Artery; *v*, Vein.

Successful result in a case of large cirsoid aneurism of the scalp. Blood-supply controlled by acupressure-pins applied to external terminal branches of nutrient arteries. Subsequent crucial incision and vascular tissue entirely removed between the skin and periosteum of flat bones. Compression applied; complete recovery. W. S. Forbes (Med. News, June 15, '95).

Case of cirsoid aneurism of the scalp; ligature and acupressure followed by immediate and complete excision; recovery. J. J. Pratt (Lancet, July 3, '97).

Cirsoid aneurism of the scalp following a fall against a curb. In spite of the probable hæmorrhage, the best treatment in this location is excision of the aneurism entire. The child was well in a week. Broca (Jour. de Chir., Apr.-May, 1901).

Arterio-venous Aneurism.

Varieties.—An artery and a vein may intercommunicate in two ways: (1) when the one vessel opens into the other by a short channel—the so-called *aneurismal varix*—and (2) when between the two

Fig. 2.—Diagram of varicose aneurism. *a*, Artery; *v*, Vein; *s*, Sac, containing a laminated clot on each side of the channel; *t*, Intervascular tissues.

vessels there is an adventitious sac: the so-called *varicose aneurism*. Although both terms are incorrect and misleading, they serve to establish a distinction which becomes important when the treatment is considered, the measures indicated in aneurismal varix being dangerous in varicose aneurism.

The difference between the two varieties is illustrated in the wood-cuts printed above.

Symptoms.—The receipt of the injury may be attended by syncope if internal vessels are wounded, but superficial vessels are by far those most frequently involved, and aneurismal varix may last for years without serious disturbance. The most common situation of this variety is the bend of the elbow, the result of punctured wounds which penetrate both vessels.

A whirring sound, like the purring of a kitten, is produced by the current passing from the artery into the vein. This sound was compared by Spence to the noise made by a fly in a paper bag. It is more distinct above than below the tumor, and the limb is usually somewhat weaker and colder than is natural. A thrill is felt when the hand is applied over the tumor.

In varicose aneurism there exists, as already stated, a sac between the two vessels; but it is important to remember that this sac is not constituted of the coats of the vessels involved; it is an artificial formation at the expense of the tissues between the vessels. These having been simultaneously wounded, the lymph effused in the course of the inflammatory process forms a partition to limit the extravasation. This extravasation differs from that of a false aneurism in that it communicates with a vein.

The difference between aneurismal varix and varicose aneurism consists, besides the presence of the adventitious sac, of a greater length of the intervening canal in varicose aneurism. A laminated clot on each side of this canal contributing also to reduce its diameter to that of the canal in aneurismal varices, taken as a whole, the symptoms of both conditions are about similar. Palpation sometimes makes it possible to detect the presence of the intervening sac, and also, in addition to the thrill and buzzing sound of aneurismal varix, a distinct impulse. An aneurismal murmur or soft bruit may frequently be elicited. The conformation of varicose aneurism is not such as to tend toward much enlargement.

If, according to Tillmann, the point of communication between the artery and vein be compressed, the pulsation in the dilated and tortuous vessels ceases, and they collapse.

The limb is generally wasted below the varix if the case is one of long standing; it may also be œdematous, hard, and enlarged.

In twenty-nine cases of aneurism of the ascending arch of the aorta opening into the vena cava analyzed by Pepper and Griffith, a thrill was observed in some cases; in others a continuous murmur with systolic increase, with sudden development of cyanosis, œdema, and engorgement of the veins of the upper part of the body.

> Case of traumatic arterio-venous aneurism of the arch of the aorta and the innominate vein. The thrill was most distinct over the manubrium sterni, and could be followed down the internal jugular and left brachial veins and over the skull in the course of the sinuses. The autopsy showed an opening in the arch of the aorta between the points of origin of the carotid and the innominate arteries, which communicated directly with the left innominate vein: dilated at this point to the size of an orange. Long survival after the accident is worthy of notice. Colzi (Lo Sperimentale, Feb., '95).

Etiology. — Both varieties are caused by traumatisms by which an artery and vein in juxtaposition are wounded simultaneously from a stab or in phlebotomy. Arterio-venous aneurisms were much more frequent when venesection was in vogue than they are now that this procedure is rarely resorted to.

A true aneurism may gradually adhere to a vein, and give rise to an arterio-venous aneurism.

Case of spontaneous, probably congenital, arterio-venous aneurism of the arm and hand, caused by an abnormal communication between the common interosseous artery and a deep branch of the cephalic vein. Ligature of the brachial artery followed by gangrene of the forearm and hand; amputation; recovery. Weidemann (Beiträge zur klin. Chir., Sept. 15, '93).

Pathology. — Besides the features already noted is the fact that the wound between the vessels does not heal, so that at each pulsation a certain amount of blood is forced through from the artery into the vein. The latter pulsates strongly and becomes tortuous and dilated; the veins beyond the aneurismal varix on the limb are likewise dilated. The artery is more or less dilated above, but much contracted below, the lesion.

Prognosis.—An aneurismal varix may, as already stated, cause no very serious disturbance, and is not, therefore, regarded as a dangerous condition. This is not the case, however, with varicose aneurism, as the intervening sac may at any moment become disorganized and give rise to a diffuse aneurism. The varicose veins may also become greatly enlarged, and be followed by œdema and perhaps gangrene.

Case of fourteen years' standing, caused by a punctured wound of the axilla. Arm normal, veins not distended, function perfect, but all over the arm the characteristic bruit could be heard; operation contra-indicated. Osler (Annals of Surgery, Jan., '92).

Case of aneurismal varix of the left internal carotid artery and the cavernous sinus. It has remained unaltered for twenty-three years. C. E. Williamson (Brit. Med. Jour., Oct. 13, '94).

Fourteen cases of arterio-venous aneurism of subclavian published. Case in which there was no syncope at the time of accident and seven months after development of aneurism no functional trouble. Wedenkind (Deutsche med. Woch., No. 16, '95).

Treatment. — In the majority of cases *aneurismal varix* requires no treatment, or no more than the application of an elastic bandage to prevent its growth.

Where extension of the affection causes pain and disturbance in the circulation, compression may be applied above and below and upon the tumor itself; should this not succeed, the artery and vein can be tied above and below the opening, and the aneurism removed. It is only when absolutely necessary that aneurismal varix of the femoral vessels or of the carotid and internal jugular should be submitted to operative procedures.

Unlike aneurismal varix, *varicose aneurisms*, as stated, present an element of danger: the intermediate sac, owing to its histological composition, tending to ulcerate at any moment and to give rise to a diffuse aneurism. Pressure is obviously contra-indicated; it would cause enlargement of the already dilated veins and probably give rise to œdema and gangrene. The best treatment, especially when the aneurism is small, is to tie both vessels above and below the aneurism, and to remove the latter.

Case in which arterio-venous aneurism followed a wound of the popliteal artery and vein by a spicule of glass. Operation was performed four and one-half weeks after the accident. The sac was opened, both vessels discovered to be injured, and, after an unsuccessful attempt to close the vein by suturing, both were ligated. Of 7 cases of simultaneous ligation of the popliteal artery and vein, in 6 of which these vessels had been wounded, all recovered, 1 after amputation for gangrene. In 8 other cases the results were

entirely favorable. G. P. Newboldt (Lancet, Apr. 23, '98).

In varicose aneurism of the neck or femoral vessels, it is best to cut down upon the artery below and above the sac and ligate without touching the vein or the sac. This method was suggested by Spence, of Edinburgh.

In cutting down upon a varicose aneurism, the incision intended to open the enlarged vein should be followed by one opening the sac, so as to bring the aperture within the artery into the field of operation.

Hunter's method of ligating the artery above the sac is not successful, as the unimpeded circulation of blood into the sac through the vein prevents coagulation of the fibrin. In a general way, it may be said that all small aneurisms, not involving the larger vessels of a limb, should be extirpated, unless important nerves are jeoparded by the dissection, or, as on the face, where it is important to not leave a scar. The treatment selected for larger aneurisms depends upon their situation. Those of the neck which involve the external jugular vein will rarely require treatment, but, should it be necessary, such cases are best treated by double ligation of both vessels. In other situations the simple ligature of the vessels should not be chosen, for it will, in most cases, require as much dissection as will incision or extirpation, while not giving the same immunity from relapse. The surgeon should make an incision down upon the sac in its entire length, and attempt to dissect it from its bed. If this prove difficult or impossible because of inflammatory thickening or intimate connection with important parts, the sac should be incised, for it is often easier to secure the vessels when the sac is freely opened. The sac could then be left entirely in place or it could be partly removed. Suture and simple drainage of the sac have been found sufficient, and it is unnecessary to resort to packing. (Farquhar Curtis.)

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ANGINA PECTORIS.

Definition. — Angina pectoris (stenocardia, breast-pang) is the name given to a group of symptoms which usually depends upon organic disease of the heart or aorta. An attack consists in the sudden onset of agonizing pain in the præcordial or sternal regions, accompanied by a feeling of constriction and in severe cases by a sense of impending death. The pain radiates into the back, the shoulders, and the arms, particularly the left. The patient is pale, haggard, motionless, and often bathed with cold perspiration.

Symptoms.—Suddenly, after exertion, excitement, or a hearty meal, the patient feels an excruciating, burning, or tearing pain in the heart or beneath the sternum, accompanied with a sense of constriction (*angere*, to throttle), as if the heart were in a vise. The pain radiates into the back, upward into the shoulders, and down the left arm, often even to the finger-tips. It may be felt in both arms, in the neck and head, and even in the trunk and lower extremities. "In true angina the seat of the pain may be entirely away from the chest, and may be, as in Lord Clarendon's father, at the inner aspect of the arm, or about the wrist, or in rare instances confined to the side of the neck, or even to one testis." (Osler.)

Attacks occur in which pain is slight or absent (angina *sine dolore*). Early attacks are often of this sort. At a later

period there may still be no pain, or the paroxysms may sometimes be painful and at other times not.

A feeling of numbness accompanies the pain. There is a sense of impending dissolution. The sufferer sits or stands immobile and hardly dares to breathe. Yet there is no real dyspnœa. The face is pale or livid, the forehead wet with perspiration. The pulse may remain strong and regular. Usually it is accelerated and of increased tension. It may intermit or vary. Exceptionally it is slowed. The paroxysm lasts a few seconds or minutes,—sometimes half an hour or even several hours. At the end of it the patient often belches gas or vomits or has a movement of the bowels, with great relief. The attack may prove immediately fatal. If not, the patient is left exhausted, but regains his usual condition in a few hours or days.

Study of twenty-one cases. The attacks usually came on after a meal. In every case exertion increased the pain, and the sense of fullness was relieved by the eructation of gas. Most of the patients attributed their trouble to indigestion. In all there was shallow respiration with an occasional deep inspiration. The heart was usually slow, occasionally palpitating or irregular, and the pulse was generally tense and sustained. In all arterial fibrosis could be recognized by a thickening of the palpable arteries; cardiac disease—manifested by accentuation of the second aortic tone, feebleness of the first sound, cardiac murmurs, etc.—was present at some time in nearly all cases. During the attacks the second aortic sound was always much accentuated, while the first sound could be heard very indistinctly. Frank Billings (Chicago Med. Recorder, Feb., 1901).

The attack is almost sure to be repeated. This may happen in an hour or not for weeks or months. The length of the interval depends greatly upon the persistence of the patient in avoiding the exciting causes. Successive paroxysms occur with gradually increasing readiness.

Angina pectoris is probably due to increased intravascular pressure. We can reasonably infer the presence of dilatation of the heart by the physical signs of displaced apex-beat; gallop-rhythm; a soft, regurgitant murmur in the tricuspid or mitral area; by venous phenomena; and by the congestions, cyanosis, and dropsy that attend this affection. The results of cardiac percussion may be confirmatory, but are not looked upon as essential in the diagnosis of cardiac dilatation. Five cases to illustrate the following propositions:—

1. When dilatation of the heart supervenes in a patient the subject of an attack or attacks of angina pectoris, the subjective symptoms may subside. At the same time the physical type of the individual changes.

2. Angina pectoris may occur in a patient who has had dilatation of the heart when the organic condition (dilatation) is removed by treatment. J. H. Musser (Amer. Jour. of Med. Sciences, Sept., '97).

Attention drawn to that form which is found in association with dry pericarditis: the pain in these cases is situated at the base or middle of the sternum; it may also be in the epigastrium and over the cardiac area. It radiates outward toward the arms. These signs, in truth, afford no differentiating clue. On careful auscultation, however, to-and-fro friction may be heard coincidently with the cardiac movements, with hyperæsthesia in the præcordial region; and the facts of its frequently following tonsillitis and rheumatic ailments, and not being amenable to the operation of vasodilators and stimulants, serve to distinguish it from most cases of coronary angina: it is an exocardial angina. The treatment of the condition is, naturally, that of pericarditis. M. Pawinski (La Semaine Méd., Oct. 6, '97).

Special variety of musical heart-mur-

mur, resembling a feeble groan or chirping of chickens. Similar cases described by Capozzi, in which a constant lesion was found, namely: a regular perforation of a free valve. Case of a man, aged 30, suffering from anginal attacks. Double aortic murmur, the diastolic part of the murmur being musical. The apex-beat was in the fifth space, outside the nipple-line. No history of rheumatism. History of syphilis. Death in one of the attacks of angina. At autopsy mitral valves found normal; aortic valves thickened, two cusps being adherent; the third was perforated near the aortic parietes, but not adherent. Coronary arteries healthy. Tecce (La Rif. Med., Apr. 2, '97).

Diagnosis. — In true angina pectoris skilled observers almost invariably find evidence of organic cardiac or aortic lesion. In a supposed case these should be sought most carefully. Particularly to be looked for are arteriosclerosis, hypertrophy or dilatation of the left ventricle, aortic regurgitation, and feebleness of the muscular power of the heart.

True angina always associated with cardiac lesions, especially of the coronary arteries; but the absence of physical signs do not always affect the diagnosis, as it frequently occurs that the lesions are only discovered after death. Presumptive signs which deserve attention:—

The age of the patient; true angina is very rare before forty.

The pain commences always in the heart, while in pseudo-angina it is ascribed to the arm and radiates in several directions.

The infrequency of the attacks in true angina, the patient being liable to succumb in the second or third attack.

True angina is provoked by effort, emotion, and disorders of digestion.

It occurs in the day-time, while in false angina the attacks are generally nocturnal.

Patients suffering from true angina are pale and can neither stir nor breathe. In the false angina he is agitated, gets up from bed, and runs to the window for fresh air. Rendu (Med. Press and Circular, July 22, '96).

Diagnosis of angina pectoris due to disease of the coronary arteries, based upon retrosternal pain, with tendency to radiate; a sensation of anguish and fear of imminent death; the tendency of the attack to be excited by exertion, by emotion, or by exposure to cold. The pain is similar to that experienced in a limb the main artery of which is, by atheroma, diminished in calibre. Owing to the defective supply of arterial blood, the heart contracts in a manner painful to the patient, the peripheral nerve distributions wanting a due supply of oxygen. P. Merklen (La Semaine Méd., Aug. 9, 1900).

Intercostal neuralgia causes pain along an intercostal nerve, not radiating as in angina pectoris. It presents points tender to pressure near the vertebræ and sternum and in the axilla. It is not associated with disordered circulation.

Gastralgia is apt to occur when the stomach is empty. The pain does not stream into the shoulder and arm. While there may be collapse and a sense of impending death, there is no evidence of heart disease. Both gastralgia and intercostal neuralgia are likely to occur in anæmic young women, rather than in middle-aged men.

On the other hand, the pain of true angina pectoris may be felt lower down than the præcordia.

As already stated, the termination of an attack may be marked by the discharge of gas. Particularly if there is no extreme cardiac pain, this may lead the patient, and in some instances has led his physician, astray.

It is important to bear in mind that symptoms of cardiac embarrassment assuming the character of "angina *sine dolore*" may be described by the patient as arising from dyspepsia. These patients ascribe their discomfort to flatulent distension, and they do so from the

well-known fact that a discharge of flatus gives relief to the uncomfortable sensation. It is well, in advanced middle life, to pay rather more than ordinary attention to flatulent discomfort coming on after food or exertion. A careful examination will often solve the problem and will conclusively prove that the symptoms are rather those of cardiac inefficiency than of stomach trouble. D. W. C. Hood (London Lancet, Sept. 26, '96).

Cardiac asthma is dyspnœa due to a weak heart and occurring more or less paroxysmally. Pain is not prominent. The picture is apt to include pulmonary œdema, enlarged liver, and dropsy, and it could hardly be mistaken for angina pectoris. It should be remembered, however, that angina may attack a person who is already suffering from failing compensation.

Pseudo-angina pectoris, or hysterical angina, occurs in females or neurasthenic men, usually under the age of 40, without evidence of organic cardio-vascular changes. There are low tension, feeble second sound, and soft arteries. The attacks are spontaneous and are apt to be nocturnal and periodic (menstrual). They last an hour or two, being more prolonged than the true paroxysms. The patient is agitated, writhes, or walks about the room, and talks. The heart feels, not constricted, but distended. The pain is not apt to be so severe as in true angina pectoris. Paræsthesiæ and vasomotor symptoms are prominent. Death never occurs.

Hysteria. — It should, of course, be remembered that hysteria may be combined with organic disease, and that a careful physical examination should be made in any suspected case; but the discovery of mitral disease would not be inconsistent with a diagnosis of pseudo-angina.

Syphilis. — A history of syphilis in a man, even if under 40 years of age, renders the occurrence of true angina pectoris less improbable than it otherwise would be, for there is a possibility of syphilitic aortitis obstructing the orifices of the coronaries.

Tobacco, Tea, etc. — Excess in tobacco (less often alcohol, tea, and coffee) and lead poisoning may occasion spurious angina, or again they may aggravate a genuine paroxysm depending on organic lesions.

While certain cases are evidently true angina and others equally obviously pseudo-angina, some are extremely puzzling.

Etiology. — Males over 40 years of age in comfortable worldly circumstances make up the majority of sufferers from angina pectoris. Predisposing causes are: alcohol, syphilis (arteriosclerosis, tabes dorsalis), rheumatism, gout, diabetes, chronic nephritis, and influenza. Sometimes attacks are hereditary.

As exciting causes may be named: physical exertion, mental strain, profound emotion, and digestive disturbances. The attacks may come in the day-time, especially at first; but some of the worst occur at night; so that finally they may make the patient dread going to sleep.

Angina pectoris and the menopause. Attacks of angina pectoris observed for the first time at the menopause may be dependent upon the changes occurring at this period, or they may accidentally begin at this time from other and unassociated causes. In the former case the attacks may be purely neurasthenic or hysterical, or they may be of vasomotor origin (spasm of the coronary arteries), giving the picture of severe organic angina pectoris. These two forms may, of course, be combined. Th. K. Geisler (Vratch, Feb. 12, 1900).

While, in general, the vascular origin of angina pectoris cannot be denied, cases occur which undoubtedly are due to lesions of the aortic or coronary plexus, and the cases cited are thought to justify the belief that in syphilitic angina pectoris, in which a coronary stenocardia might be considered probable, there exist changes in the aortic plexus and in the nerves of the heart. This alteration of aortic or cardiac plexus may be in the nature of a neuritis, or may be due to changes in the vessels of the nerves, the functional effects of which would be equivalent to a lesion of the nerve proper. Such changes in the nerves or vasa nervorum are caused by a terminal obliterating endarteritis, pericellular infiltration, or embryonic gummata which irritate the vessels. These changes can, in the large majority of cases, be controlled by energetic specific treatment; hence the importance of early etiological diagnosis. U. Benenati (La Riforma Medica, May 3, 5, 6, and 7, 1902).

Pathology.—It is exceptional for attacks of true angina pectoris to be observed in persons presenting no evidence of organic circulatory lesion. The commonest underlying conditions are sclerosis of the coronary arteries, degeneration of the myocardium, cardiac hypertrophy, atheroma of the aorta, aneurism of that vessel near its origin, and aortic regurgitation. There is, however, "hardly an affection of the walls or cavities of the heart, scarcely a morbid condition of the arteries that nourish it or spring from it, with which the distressing malady has not been observed to be associated." (Da Costa.)

Recent writers lay stress on obliteration of the lumen of the coronary arteries as the essential basis of true angina pectoris, which obliteration may be occasioned either by sclerosis of the vessels or by changes in the aorta at their origin. "So intimately associated is the true paroxysm with sclerotic conditions of the coronary arteries that it is extremely rare apart from them." (Osler.) (Same view. Whittaker.)

Case of angina pectoris without lesions of the coronaries in which death occurred during a paroxysm. Aortic and mitral endocarditis was found post-mortem, but no lesion whatever of the coronaries. Numerous personal autopsies on the bodies of old people, at the Bicêtre Hospital, where there had been no complaint of angina during life, and yet the coronaries were found to be almost occluded by atheromatous plaques. Pilliet confirmed these observations. He had found a large number of obstructed coronary arteries which had never caused angina. Auscher (Bull. de la Soc. Anat., Oct. 9, '91.

The immediate, precipitating conditions of a paroxysm are not known, but they are supposed to be connected with disturbances of the vagus, or, perhaps, the sympathetic nerves. Nothnagel reported a series of cases under the title "Angina Pectoris Vasomotoria" which seemed to be due to a pure neurosis. They followed exposure to cold, and were ushered in by spasm of the peripheral arterioles, which presumably produced the cardiac disturbance because of the increased exertion demanded of the heart in order to propel the blood through narrowed channels. Cases of this sort must be rare. Authors quote Nothnagel without mentioning similar personal observations.

From a neuralgia or a neurosis true angina pectoris differs in being usually fatal, in attacking men ten times as often as women, and in being associated with organic changes in the neighboring structures, viz.: the heart and aorta.

Lesions of the cardiac plexus and the branches of the vagus have been found in repeated instances of angina pectoris, but that such lesions are invariably pres-

ent and essential to the disorder has not yet been proved. "The cardiac nerves may be seriously implicated in aneurism, in mediastinal tumors, in adherent pericardium, and in the exudate of acute pericarditis, without causing the slightest pain." (Osler.)

The late Sir Benjamin W. Richardson regarded angina pectoris as an actual disease analogous (as Trousseau held) to epilepsy, and due to a disturbance in the sympathetic nervous system.

Debove says that in tabetic angina pectoris there is no organic lesion of the heart or large vessels and that the attack must be regarded as a visceral crisis. Dana refers cardiac crises in tabes to a degenerative irritation of the vagus.

> [It should, however, be remembered that aortic disease is rather frequent in tabetic patients. H. F. VICKERY.]
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> The various theories which have been advanced fail to explain the production of this disease satisfactorily. Disease of the coronary arteries causes an unequal distribution of blood to the degenerated myocardium. So long as the heart is acting quietly, the degenerated tissues are able to resist and overcome the intracardiac pressure; however, when more work is thrown upon the heart, the areas of muscular degeneration are unable to supply the increased demand for work and therefore undergo stretching, and herein lies the explanation of the pain. Colbeck (Lancet, March 21, 1903).

In regard to the causation of attacks of angina pectoris in the graver cases which are associated with serious structural disease of the heart and vessels, J. Burney Yeo states that in by far the greater number of deaths from organic disease of the heart all the various lesions may be present which have been found in fatal cases of angina and yet no true anginal attacks have ever been complained of. In his opinion there is some additional circumstance needed to account for the angina. The most serious forms of angina seem to have a complex causation. First, there must be a neurosal element; the nerves of the cardiac plexus suffer irritation, and an intense cardiac nerve-pain is excited; this acts as a shock to the motor nerves of the heart, and thus reacts on the heart-muscle, which, in fatal cases, is already on the verge of failure from organic causes; and, if there should be excited at the same time some reflex arterial spasm, the heart will have to encounter an increased peripheral resistance as well. In such cases the rapidity of the fatal issue is no argument against the neuralgic nature of the angina. In certain conditions, especially in habitual high arterial tension, strain is apt to fall (when the aortic valves are competent) rather on the first part of the aorta than on the ventricular surface, and anginal attacks are more prone to occur in these cases, as this part of the aorta is in such close relation with the nerves of the cardiac plexus, rather than in those cases in which the strain is felt on the interior of the cardiac cavities. The causation of the less grave and more remediable forms of angina is also, in many instances, complex. A cardiovascular system, feeble and poorly nourished, on account of anæmia, may be submitted to undue strain; or there may be some intoxication—such as that of tea, tobacco, alcohol, gout, or some intestinal toxin—irritating the cardiac and vasomotor nerves, increasing peripheral resistance, and so exciting anginal attacks, which may altogether pass away and be completely recovered from. Vasomotor spasm, as a unique cause of attacks of angina, must be set aside as inconsistent with extended clinical experience. Cases of angina pectoris, both of the milder and graver forms, occur

without any evidence of vasomotor spasm or of heightened arterial tension; and the conditions of heightened arterial tension, together with a feeble cardiac muscle, very commonly co-exist, without any tendency whatever to the development of anginal attacks. The argument in favor of a vasomotor causation has been inferred from therapeutic experiment and the relief to the paroxysm which has attended the use of agents which cause arterial relaxation. But most, if not all, of these vasodilators are also anæsthetics, and, as Balfour has pointed out, it is probably to their anodyne action on the sensory cardiac nerves that they owe their chief efficacy; Grainger Stewart has also pointed out that nitrite of amyl has a direct effect on nervous structures, and that it relieves other forms of neuralgia.

> Angina pectoris is due, not to an increase, but to a further reduction, of the muscular energy of a heart already enfeebled: the Stokes-Parry theory. The associated pathological processes are sclerosis of the coronary vessels, alterations of the aortic valves, and ectasic aortitis, which latter has a special stenotic effect upon the origin of the coronary vessels. These conditions, together with the resistance of the contracted arterial system, induce weakening of the heart. A moderate distension of the heart may lead to a temporary occlusion of the coronary vessels at the point of an already existing constriction, and so bring on an attack of angina pectoris. In other cases a thrombus or embolus may be the cause of the block. T. Schott (Lancet, Sept. 8, 1900).

Prognosis.—The underlying condition is apt to prove fatal eventually, and it may end life in the first paroxysm; but a careful regimen may prolong existence for years; and Flint, Bendel, and Labolbary have each reported cases of recovery.

The signs of danger during any particular attack are the subjective sense of impending death and the feebleness and irregularity of the pulse. The general prognosis is, of course, influenced by the stage which the organic circulatory changes have already reached.

The pseudo-attacks are apt to be repeated oftener than are the genuine, but the prognosis is good both as to life and to the final disappearance of the trouble.

> True angina, when it occurs in dilatation of the heart, admits of a prognosis more favorable than when it occurs with other mural conditions, as myocarditis or hypertrophy, without dilatation.
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> Grave cases of dilatation of the heart, conversely to the above, may be looked upon as amenable to successful treatment if the patient should have paroxysms of true angina pectoris. J. H. Musser (Amer. Jour. of Med. Sciences, Sept., '97).
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> The majority of writers hold that true angina pectoris (that is, combined with anatomical lesion of the heart, fatty degeneration sclerosis of the coronary arteries, etc.), generally ends sooner or later in sudden death, and that recovery is a rare exception. Personal experience in seventy-three cases has shown that this statement holds good only of patients in whom angina is combined with aortic insufficiency. Among the other cases there was only a single patient who died suddenly after the disease had lasted three years. Most of them after treatment recovered sufficiently to undertake laborious work; a few were completely cured, and in only three cases did no improvement take place. Of these one was a drinker and a great smoker, another suffered from pleurisy, while in the third arteriosclerosis went on developing, aortic insufficiency was produced, and the patient died suddenly. Fr. Somberger (Sbornik Klinicky, vol. i, Fasc. 1, '99).

Treatment. — During a paroxysm the first remedies to employ are such as will dilate the arterioles. Nitrite of amyl is the best because it acts with the greatest rapidity. A "pearl" of this drug may be crushed in a handkerchief or in cotton placed in the bottom of a glass tumbler,

and inhaled. Nitroglycerin may be injected subcutaneously ($^1/_{100}$ to $^1/_{50}$ grain), or a tablet of this substance may be masticated. It is readily absorbed from the mouth and acts almost as quickly as when given hypodermically.

For treatment of attack itself, rest, the inhalation of 5 or 6 drops of nitrite of amyl and an hypodermic injection of $^1/_{100}$ grain of nitroglycerin are to be resorted to. To overcome the syncope ether, caffeine, or camphorated oil, the latter in 10-per-cent. strength, are to be employed. Friction should also be applied to the limbs and, should there be evidences of pulmonary involvement, venesection must be practiced, while, if respiration fails, rhythmical tractions of the tongue must be performed. Fifteen- to 45-grain doses of antipyrine may be given by the stomach or by rectal injection, or smaller amounts of phenacetin may be used; to the point of pain chloride-of-ethyl spray may be applied. Lyon (Revue de Thér. Med.-chir.; Ther. Gaz., Oct. 15, '98).

In angina pectoris pearls of amyl-nitrite recommended, especially in the beginning of the attack. The dose is from 5 to 10 drops. Should the attack last for any length of time injections of nitroglycerin advised. A good formula is as follows:—

℞ Spirit of nitroglycerin, 10 minims.
Cherry-laurel water, 3 drachms.

M. Twenty minims to be injected subcutaneously.

Small blisters to the præcordium are often useful. Between attacks the diet should be very limited and the use of alcohol and tobacco be forbidden. Iodides should be given for at least from two to four years following an attack, and it is well to alternate the sodium and potassium salts and combine them with digitalis or caffeine. Huguenin (Allgemeine med. Central-zeit., No. 14, '98).

Relief by these means is often immediate; but, if not, ether should be inhaled. Chloroform is also advised by excellent authorities. Flint thinks it not without danger, if the heart is weak; ether, on the other hand, is a stimulant. Morphine, subcutaneously, is a valuable and sometimes an indispensable remedy. Whittaker suggests that it be given with caution in a condition which may anyway terminate in sudden death. The morphine ($^1/_4$ grain) may be guarded by atropine ($^1/_{150}$ grain), and in case of alarm also by strychnine ($^1/_{30}$ to $^1/_{20}$ grain). Electricity has also been recommended.

Electricity is generally unreliable or dangerous, and faradization should be used only in threatening syncope. Huchard (Univ. Med. Mag., May, '92).

The application of the continuous electric current along the course of the vagus in the neck and down the arm, in cases where a distinctly painful aura is experienced in the hand, has been found useful in warding off attacks. Burney Yeo (Practitioner, May, '93).

Electricity certainly seems to exercise its best effects in those cases in which the pain is of a very positive neuralgic character, with no co-existing organic disease, although the presence of structural changes in the heart and blood-vessels does not contra-indicate the judicious use of either form of current. Rockwell (Hare's "System of Practical Therap.," vol. i, p. 394).

Hot and stimulating applications over the præcordia, such as a strong mustard poultice, are appropriate, as are also heat and friction for the extremities. Sometimes an ice-bag is put over the heart. Alcohol and aromatic spirit of ammonia are of benefit in case the cardiac action is feeble. Syncope demands such drugs as digitalis, digitaline, caffeine, strychnine, and camphor, employed hypodermically. I have known oxygen to contribute to a favorable result in collapse due to chronic myocarditis with dilatation of the left ventricle, and cannot see why it might not be well for a subject of angina pectoris to keep some ready in his house.

Between attacks it is of vital importance to avoid the predisposing and ex-

citing causes. Rest and moderation are demanded. As for drugs, nitroglycerin, taken after meals in doses just short of causing headache, has a distinct inhibitory effect upon the paroxysms. In some instances it might be better to order it every three hours, as its influence is not long continued. Nitrite of sodium (2 to 5 grains) may replace nitroglycerin.

A new remedy is erythrol-tetranitrate in grain doses four times in the twenty-four hours. If this drug is given in spirit and water (1 grain in 1 drachm of alcohol and 7 drachms of water) the tension begins to fall in two or three minutes; if given in a pill, the time is twenty to forty minutes; if given in tabloid form and chewed, the time lies somewhere between the two. The drug was not introduced to replace amyl-nitrite and nitroglycerin in cutting short attacks, but only to replace them in preventing the onset of the attacks. J. B. Bradbury thinks the tablet undoubtedly the best form of administration.

Severe case in a physician, in which erythrol-tetranitrate (1-grain doses) was taken steadily, at eight hours' interval, as a prophylactic. For three weeks there was immunity from attacks, although some weariness and oppression came on after six or seven hours from taking the tablets. Now taken four times in the twenty-four hours with marked relief.

The initial fall of the pulse-tension depends on the mode of administration. If the drug is given in spirit and water (1 grain in 1 drachm of alcohol and 7 drachms of water) the tension begins to fall in from two to three minutes; if given in a pill and swallowed, the time is from twenty to forty minutes; if taken in tablet form and masticated the time lies somewhere between the two. The best form of administration is undoubtedly the tablet. The alcoholic solution sometimes irritates the stomach. Bradbury (Brit. Med. Jour., Apr. 10, '97).

Erythrol-tetranitrate in angina pectoris. Case in which glycerin soon lost its effect, and its administration was attended by severe headaches. Erythrol-tetranitrate was substituted in tablets of $^1/_{6}$ grain, each, two to three times a day. This produced a cessation of the attacks, the administration of the remedy being attended by the same vasodilator effect noted in the use of the nitrites and glonoin, but the action was much more sustained. Boughton Addy (Brit. Med. Jour., May 6, '99).

The persistent use of potassic iodide is very effective. Ten or 15 grains may be given thrice daily before meals in half a glass of water; or 20 grains three times a day for twenty days, followed by nitroglycerin for ten days. The iodide is believed to dilate the arterioles and to promote arterial nutrition. Sée supposed that also by enlarging the calibre of the coronary arteries it invigorated the myocardium.

Arsenic in small doses also tends to avert the paroxysms. In case of fatty degeneration of the heart it would be contra-indicated.

Quinine and methylene-blue have also been recommended.

The treatment by saline baths and by the Schott method of exercises has a most potent effect in improving the condition of the cardiac muscle and vessels, and appears to have a direct effect in making the attacks less numerous and severe, and even in causing them to cease during a period of months or years. The movements must be made with especial care and caution in these cases, and the resistance at the onset must be at a minimum. The artificial saline baths should contain from 1 to 3 per cent. of salt, and from $^1/_{4}$ to 1 per cent. of chloride of calcium, and should gradually be strengthened by the addition of carbonic acid. (H. N. Heineman.)

Angina pectoris with pseudostenocardia. The angina is due to probable endo-aortitis, and is relieved by an exclusive milk diet and theobromine for two weeks. Then, one week every month, milk diet and sodium iodide. During the balance of the month, special diet, with the theobromine continued. H. Huchard (Jour. des Praticiens, Feb. 23, 1901).

The writer confirms the remarkable benefit to be derived from theobromine in these conditions as announced by Askanazy in 1895. The diuretic influence of this drug is familiar, but its property of promptly arresting the pains of angina pectoris, cardial asthma, and allied conditions is less generally known, and yet the writer considers it one of the most blessed facts in modern therapeutics. He describes over a dozen cases in detail, showing its rapidly beneficial influence in all pains of arterial origin. They form a series ranging from pure angina pectoris to attacks of pain attributed by the patients to the head, stomach, shoulder, kidney, or intestines, and apparently with no features in common with angina pectoris; yet all show by the prompt response to theobromine that they have a common origin in the arteries and that theobromine has a specific action on the latter. Arteriosclerosis and certain other affections of the arteries are liable to cause constant pains in the vessels which may radiate to remote regions. The pains may be due to increased blood-pressure and distension, but they are also liable to be caused by spasmodic contraction of the arteries. These contractions occur by preference in the smaller arteries and are the result of pathological or pathologically exaggerated reflexes originating in the diseased vascular wall. They are set in motion by various causes which raise the blood-pressure, emotions, muscular exertion, the horizontal position in sleeping, etc. They are especially liable to occur in the organs which require the largest supply of arterial blood, such as the digestive tract, heart, and muscles. The arterial fluxion induced by increased function starts the attack of pain. The spasmodic contraction of the arteries causes symptoms of ischæmia as the arterial supply is cut off from muscular organs. In the extremities it becomes evident as intermittent claudication; in the digestive tract as paresis and meteorism; in the heart, as sudden inadequacy and paralysis. Sensory phenomena may be superadded to these and it becomes difficult to decide whether the pains are due to the vascular spasm or to the ischæmic parenchyma. When the vessels of the heart are directly or indirectly involved the specific angor cordis develops. The lesions of the heart arteries may radiate the pain to remote regions. The spasm of the heart arteries is peculiarly intense when it is not the result of the usual causes, but is due to direct irritation of the intima by a thrombus or embolus. This explains the sudden death that may occur from a small embolus in one of the terminal ramifications of a coronary, as well as in case of obstruction of a large artery from this cause. Theobromine has evidently some action on the spasmodic contraction of the arteries, and when this is controlled the pain ceases. It may also act by diminishing the reflex excitability or by reducing the arterial pressure. Be this as it may, the fact is established that theobromine is a powerful and harmless remedy for pains on an arterial basis. The writer always gave it in the form of diuretin (Knoll), in doses of 0.5 gramme four or five times a day, and in the severest cases 3 to 4 grammes a day. The only objection to its use is the high price charged for the preparations of theobromine. R. Breuer (Münchener med. Woch., Oct. 14, 1902; Jour. Amer. Med. Assoc., Nov. 15, 1902).

The cardiac tonics—sparteine, strophanthus, strychnine, valerian, and in suitable cases digitalis—are of the greatest utility.

Digitalis is of doubtful utility. It should not be given unless there is an excess of dilatation. J. H. Musser (Amer. Jour. Med. Sciences, Sept., '97).

The general tendency to anæmia and defective oxygenation must never be lost

sight of, and general tonics, including the use of oxygen-gas, will be of excellent service.

> Angina pectoris is due to a simple hyperæmia of the spinal sensory centres. A spinal ice-bag from the fourth dorsal to the third lumbar vertebra, applied once or twice a day for from forty minutes to an hour, will not only relieve the attacks, but will completely eradicate the trouble. Amyl-nitrite is useful. Another remedy recommended very highly is oxygen by inhalation. Oxygen alone will relieve an attack of angina, but in combination with cold over the spine and heat to the extremities it is the speediest method of relief at our command. Most efficient formula of oxygen for administration consists of 2 parts of pure oxygen, 1 part nitrous monoxide, and 1 per cent. of ozone. B. Kinnear (Med. Record, July 16, '98).

Attacks of pseudo-angina may be treated with asafœtida, ammoniated tincture of valerian, or compound spirit of ether, and the outward employment of heat-friction and rubefacients. Sometimes recourse must be had, however reluctantly, to morphine. The statement in clear and decided language of a favorable prognostic prospect is of great benefit. Between attacks the underlying condition should be cared for. (Heineman.)

> The fact of the pain itself being capable of acting as a vasoconstrictor has been too much overlooked. Certainly morphine is the great remedy that we have usually to fall back upon when vasodilators have spent their powers of affording relief. Graham Steell ("The Sphygmograph in Clinical Medicine," '99; Phila. Med. Jour., Feb. 24, 1900).

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ANHALONIUM LEWINII (MESCAL BUTTON). — The mescal button is obtained from a plant which grows in a valley of the Rio Grande, in Mexico. The tops of the plant when dried constitute the commercial form of *Anhalonium Lewinii*, first described by Lewin. They are brownish in color, circular, and from one to one and a half inches in diameter. The button is hard and can be pulverized in the mortar with difficulty. In the mouth, however, under the action of the saliva, it swells and rapidly becomes soft, giving a nauseous and bitter taste, with a marked sensation of tingling in the fauces. An alkaloid (anhalonine) has been extracted from anhalonium. It is a glucoside, with an action somewhat like that of strychnine, and is very poisonous.

Dose. — The following preparations may be used: A tincture (10 per cent.). Dose, 1 to 2 teaspoonfuls. An extract of leaves (100 per cent.). Dose, 7 1/2 to 15 minims. Powdered leaves, 7 1/2 to 15 grains. The tincture and extract should be made according to the processes prescribed in the United States Pharmacopœia for such preparations.

Physiological Action. — Lewin found anhalonium to be an intensely poisonous drug, and that a few drops of a decoction used by him in the frog sufficed to produce almost instantly very marked changes, chiefly consisting in the appearance of skrinking of the body, so that the batrachian seemed to pass into a mummified condition. Simultaneously with these appearances, the animal raised itself upon its fore-extremities and remained standing in this position like an ordinary quadruped, or crawled about. After fifteen minutes this spastic condition passed off and he rapidly returned to his normal condition. When larger amounts were given, death occurred in tetanic rigidity. It would seem that the symptoms produced by it are closely allied to those of strychnia, for Lewin noted that even after the spinal cord was severed peripheral irritation caused tetanus. On pigeons it was found that the drug produced convulsive vomiting

in a few moments when given hypodermically. The bird spread its wings, crouched down to the ground, and if disturbed would twitch convulsively. Later the head was drawn sharply back, the mouth opened widely, and general convulsions asserted themselves. When death occurred the heart was always found in diastole. In rabbits the symptoms were those of strychnia poison. The taste of the liquid preparations is somewhat disagreeable, unless it be disguised by a suitable vehicle, such as a mixture of fluid extract of licorice and elixir of yerba santa. The powdered drug is best administered in wafer-paper, cachets, or capsules. (Lewin.)

It seems to produce an effect in the human subject resembling that of Indian hemp: visions ranging from flashes of color to beautiful landscapes, figures, etc. It depresses the muscular system without having, however, produced intoxication, as would be the case with alcohol. Anhalonium is not hypnotic and sometimes induces wakefulness.

The principal feature of the visions is the color-effect. The power of the drug seemed to be mainly due to the development of these entrancing visions. Prentiss and Morgan (Ther. Gaz., Sept. 15, '95).

Personal experience in the use of the drug. The principal phenomena were extraordinary color-visions, and also brilliant form-illusions. After-effects of the drug quite unpleasant, producing nausea and headache for several hours afterward. Symptoms produced resembling the visual phenomena of ophthalmic migraine, suggesting that possibly the drug might be found useful in this affection. S. Weir Mitchell (Jour. Nervous and Mental Dis., Sept., '96).

The important effect of the alkaloid of the mescal plant in therapeutic doses would appear to be: 1. A direct stimulation of the intracardiac ganglia. 2. An initial slowing of the heart. 3. An elevation of arterial tension. 4. A direct stimulation of the brain-centres and motor-centres of the cord, as shown by the increase in reflex excitability. Dixon (Brit. Med. Jour., Oct. 8, '98).

Investigations carried out on writer himself were made to determine the active ingredient producing the peculiar visual hallucinations described by Prentiss and Morgan, Weir Mitchell, and others. In the first place, an alcoholic extract of mescal buttons corresponding to 4 1/2 drachms was taken, and afterward an amount of the individual alkaloids corresponding to the quantity in the extract. The active ingredient was found to be mescaline. The symptoms produced, both by the alcoholic extract and mescaline (1 1/2 grains), were colored visual hallucinations, slowing of the pulse, dilatation of the pupil, loss of time-relations, heaviness of the limbs, nausea, and headache. After anhalonidine (1 1/2 to 3 3/4 grains) some sleepiness and heaviness of the head were observed, but no visions or change in the pulse. Anhalonine (1 1/2 grains) only produced slight sleepiness, while lophophorine (30/100 grain) induced a painful feeling at the back of the head and burning and redness of the face. The pulse fell from 78 to 70 per minute, but all the symptoms were transient. After a resin obtained from the plant no visions or other typical symptoms, except heaviness of the limbs, were obtained; thus the theory that this is the active ingredient is disposed of. Heffter (Archiv f. Exp. Path. u. Pharm., xl, 385, '98).

Anhalonium, in drop doses, a sustainer of the respiration and a cardiac stimulant. Seminal emissions may occur from its use without erection. A valuable adjuvant to digitalis, according to Landry.

Therapeutics.—The use of mescal buttons is credited with beneficial results in general "nervousness," nervous headache, nervous irritable cough, abdominal pain due to colic or griping of the intestine, hysterical manifestations, and in other similar affections where an antispasmodic is indicated; as a cerebral stimulant in depressed conditions of the mind,—hypo-

chondriasis, melancholia, and allied conditions; as a substitute for opium and chloral in conditions of great nervous irritability or restlessness, active delirium and mania, and in insomnia caused by pain, in color-blindness.

ANIMAL EXTRACTS. — Under this heading are included not only the extracts of various tissues at present utilized in therapeutics, but, likewise, the tissues themselves, and all the preparations, active principles, etc., that are obtained from them.

Of the animal tissues, and the products obtained from them, employed therapeutically, the ductless glands, whose functions are now known to be intimately associated with metabolism, have by far taken the lead over all other portions of the animal organism utilized. Indeed, if they continue to increasingly engage attention as they have of late, the time is not far off when antitoxins will find in them a potent rival. On this account, considerable space has been devoted to the subject as a whole; but, as the prevailing views still belong to the domain of conjecture, the purpose of this article will be to present what evidence clinicians have furnished.

Our personal views will only be incorporated in this article after the profession at large will have recognized their merit, if such exist. This work is only intended to portray generally-accepted doctrines.

The ductless glands and their preparations will first be considered in the order of their importance in therapeutics. A few pages will then be devoted to the various other organs and products at present being tried, the so-called "organic extracts," some of which are rapidly losing their claim to recognition.

Thyroid Gland.

In the latter part of the last century, King, of London, showed experimentally that the colloid substance of the thyroid gland passed directly into the lymphatics; and Schiff, in 1859, reviving views previously held by many, showed that this organ played an important part in the economy, through some substance which it secreted, and that intraperitoneal transplantation of the healthy gland in a dog shortly after thyroidectomy had been performed prevented cachexia strumipriva, which follows this operation. Then followed, in 1883, the experiments of Kocher and Reverdin, demonstrating that, in man as well as in animals, the same phenomena occurred under identical circumstances. This led the way to the investigations of Murray and Ord, who, followed by many observers, then showed that myxœdema could be counteracted by the internal administration of thyroid gland. Since then this organ has been used as a remedy in a large number of disorders and with marked success in some, the best results being obtained in conditions more or less distinctly associated with myxœdema.

Physiological Action.—Under the influence of a preparation of thyroid gland the body-weight diminishes and the excretion of nitrogen, water, carbonic acid, sodium chloride, and phosphoric acid increases, indicating a decided influence upon general metabolism.

> Increased metabolism, shown by (1) elevation of temperature; (2) increased appetite, with more complete absorption of nitrogenous foods; (3) loss of weight, with nitrogen excreted in excess of that taken in the food; (4) growth of skeleton in the very young; (5) marked improvement in body-nutrition generally; (6) increased activity of mucous membranes, skin, and kidneys. The rheumatic symptoms and the anæmia are not

only not relieved, but are frequently aggravated. G. W. Crary (Amer. Jour. Med. Sciences, May, '94).

Appearance of glycosuria as a result of the administration of tablets of thyroid gland. Ewald (La Sem. Méd., p. 357, '94).

Metabolism during thyroid treatment studied in three goitrous patients, aged, respectively, 19, 24, and 27 years, their usual diet being given. 1. The goitre diminished in size in all the cases. 2. The body-weight decreased one kilogramme in one case, and two kilogrammes in the other two cases. The diminution in weight depended on the duration of the treatment. 3. The amount of urine was increased. 4. The nitrogenous excretion appeared to be increased, chiefly through the urine. 5. The increase in nitrogenous excretion caused a negative nitrogenous balance of 5.46, 5.2, and 4.34, respectively. 6. The uric-acid excretion was increased in two of the cases examined. 7. The excretion of solid chloride and phosphoric acid was increased. The considerable increase in phosphoric-acid metabolism, mentioned by Roos, not confirmed, but only phosphoric acid in the urine, and not in the fæces, was estimated. Irsai, Vas, and Gara (Deutsche med. Woch., July 9, '96).

Experiments to ascertain whether the loss of the weight takes place at the expense of the fat of the body or of the protoplasmic tissues, such as the muscles. Conclusions: that fresh thyroid acts energetically on albuminous decomposition, but that some of the efficiency is lost to the thyroid substance in the process of making tablets or in keeping it too long. The administration of the artificial products over long periods of time is, however, not without action on albuminous substances. Gluzinski and Lemberger (Centralb. f. inn. Med., Jan. 30, '97).

Under the effect of thyroid there is an increased rapidity of combustion throughout the body, while the increased urinary flow which follows its use decreases the patient's weight considerably as well. Another important effect of the thyroid gland is to hasten cell-activity. Robert Hutchinson (Brit. Med. Jour., July 16, '98).

Following conclusions deducted from a series of investigations on thyroid treatment: 1. The loss of weight after the ingestion of thyroid is not due conclusively to loss of water and albumin, but in part, in some cases, to loss of fat. Thyroid causes, therefore, a genuine reduction of fat. 2. So far as this is due to increase of normal tissue-change it is moderate, except in myxœdema. 3. Increase of metabolism does not occur in all persons who take thyroid. It is most marked in myxœdema. 4. The proteid deficit in thyroid feeding may continue even in case of superalimentation, and is, therefore, a specific, toxicogenic effect of the substance. 5. Thyroidin shows effects on metabolism like those of the extract of the glands, but thyreotoxin and potassium iodide give no such results. 6. Absence of thyroid function causes not only defective growth and serious bodily and psychical degeneration, but also a distinct decrease of gaseous interchange, of heat-production, and of total metabolism. The excessive and abnormal function causes increased metabolism and emaciation. Administration of the gland in such cases is followed by increased metabolism and improvement of symptoms. 7. The loss of fat and albumin in thyroid feeding shows a plain analogy with the same process in Basedow's disease and is toxic when it reaches a high grade. Thyroid preparations must, therefore, be used cautiously in the treatment of obesity. A. Magnus Levy (Zeit. f. klin. Med., B. 33, p. 258, '98).

In rabbits thyroid substance produced a lowering of the blood-pressure, beginning a few seconds after the injection and persisting, with an unchanged heart-action. The fall in pressure is due to dilatation of the vessels. As substances having a similar action are found in the hypophysis extract and adrenal extract, and since, moreover, peptones have the same influence, no final conclusions can be drawn from the action of the thyroid extract upon the tone of the vessels. Béla v. Fenyvessy (Wiener klin. Woch., Feb. 8, 1900).

It seems exceedingly probable that the untoward phenomena resulting from thyroid extirpation are due to an intoxication, to some kind of an autoinfection, whose harmful influence is no longer counteracted by the normal action of the thyroid gland. The effect of thyroid transplantation or implantation, together with the positive results produced by thyroid feeding or by the use of extracts, speaks for the action of the gland by means of a secretion,—that is, at a distance from the gland; and this is against the view that some have suggested, that the toxic substances are brought to the gland and there transformed or rendered innocuous. The gland acts, therefore, not by virtue of storage or of direct blood purification. (J. W. Warren.)

Substances which diminish the excitability of the nervous system, bromide of potassium and antipyrine in particular, will diminish or suppress the convulsive symptoms following thyroidectomy. Gley (La Sem. Méd., Apr. 13, '92).

In dogs the symptoms of tetanus caused by thyroidectomy can be overcome by large doses of potassium bromide. Fifty dogs thus kept alive two years and two six years after the operation. Same results obtained with hypodermic injections of a concentrated solution of the substance of the thyroid gland, and with a solution of the gray matter of the brain of healthy dogs. Canizzaro (Deutsche med. Woch., No. 184, '92).

Intravenous injections of solutions of brain, testicle, or blood-serum have no such effects as the thyroid juice. Experiments favoring the belief that the thyroid gland has the function of preventing autointoxication, by transforming the toxic products of tissue-change into substances easily eliminated, or by directly neutralizing them by its own secretion. Vassale (Review of Insanity and Nervous Dis., June, '92).

In Bright's disease two to six thyroid glands of the sheep per week increase the density of the urine and the quantity of urea is augmented very sensibly. Gifford (Brit. Med. Jour., Mar. 31, '94).

Study of sixty cases. The action of thyroid extract is complex. It undoubtedly produces a mild, feverish condition, the action and reaction of which are often of considerable benefit. It is a direct cerebral stimulant. There is a strong probability that at some periods of life the administration of the thyroid supplies some substance necessary to the bodily economy. Bruce (Jour. of Mental Science, Oct., '94).

Experiments on dogs showing that after removal of the thyroid the urotoxic coefficient rose to nearly double. The toxicity of the blood-serum also increased after thyroidectomy. The thyro-iodine of Baumann, when given to athyroidized dogs, caused the urotoxic coefficient to return almost to the normal, and relieved most of the nervous symptoms. Spoto (Gior. dell Assoc. di Napoli, p. 526, '96).

Five mice and three guinea-pigs were treated with thyroid extract. Swelling of the face, emaciation, and loss of strength. In all cases the administration was continued till the animal died. No lesion found of either nerve-elements or neuroglia; no varicose or atrophied dendrites or loss of gemmulæ. The corpora showed no loss of angularity, and the axons and appendages were all healthy. No nuclear change in the cells ascertained; the blood-vessels were carefully examined without the discovery of any lesion. It would seem from these investigations, so far as they go, that the toxic action of thyroid is of a different nature from that of other conditions, and one which we are not, therefore, in a position to understand. Berkley (Bulletin of the Johns Hopkins Hospital, July, '97).

Two main hypotheses have been advanced as to how the secretion of the thyroid acts on the tissue of the body: First, that the tissue forms toxic substances which are neutralized by the thyroid secretion; this is the antitoxic theory. Second, that the thyroid secre-

tion promotes or regulates normal metabolism; this is the trophic hypothesis. All the newer evidence seems to point to the latter as the more probable one. H. Sneve (Columbus Med. Jour., Dec. 20, '98).

The thyroid gland is not to be regarded as an organ pouring a useful internal secretion into the circulation; the lymph leaving it, and the lymphatic glands in the vicinity, do not contain iodine; and the blood and central nervous system in healthy animals are also free from iodine. Removal of the thyroid is followed by disease and death, because the organ which removes poisonous substances from the blood can no longer protect the animal. It is the central nervous system which principally suffers, and by Nissl's method great changes (chromatolysis) can be demonstrated in the ganglion-cells. The thyroid, therefore, appears to be the great protective organ to the central nervous system. The poisonous substances are destroyed by oxidation, and this appears to be assisted by combinations with the iodine. F. Blum (Pflueger's Archiv, 70, '99).

Iodine-holding proteid compounds are almost wholly separable from the gland by water. The total iodine of the gland is so distributed that about 96 per cent. can be separated by alcohol, acids, etc., as iodo-albumin compounds in firmly bound form. Thyroidin does not occur free in the gland. R. Tambach (Zeit. f. Biol., xxxvi, No. 4, p. 549, '99).

Removal of the thyroid *alone* invariably causes myxœdema, while removal of the four parathyroids produces the acute tetanic symptoms observed after so-called experimental "thyroidectomy." The partial tetany sometimes observed after apparent removal of the thyroid in man is most likely really due to the inadvertent removal of some of the parathyroids along with the thyroid proper. The symptoms of myxœdema can be fully explained by the absence of iodothyrin from the blood which such removal entails, and the symptoms of parathyroidectomy are not yet susceptible of any satisfactory explanation. Robert Hutchison (Practitioner Apr., 1901).

Active Principles of Thyroid. — It is quite clear that the thyroid gland is especially characterized by the presence of a compound proteid of peculiar constitution, and that this substance, which Robert Hutchinson calls "colloid matter," is the active constituent of the gland There is also present another proteid, a nucleo-albumin, in small amount, which Hutchinson considers as probably contained in the cells of the acini. In addition there are certain extractives to be found,—viz., xanthin, hypoxanthin, inosite, volatile fatty acids, paralactic acid, succinic acid, and calcium oxalate, —bodies, however, of no special physiological significance. (R. H. Chittenden.)

Iodine has recently been shown by Baumann to be a normal constituent of the thyroid gland. Thyro-iodine—the name given by him to the product obtained—contains over 9 per cent. of iodine, and it becomes inert when the latter agent is removed from it. Baumann has also shown that the amount of iodine in the gland is much greater when the organ is normal than when it is goitrous.

> Thyro-iodine is best prepared by treating the gland with a solution of sodium chloride. The globulin is precipitated by a current of carbonic acid, and the solution acidified and boiled, when a precipitate of albumin and thyro-iodine falls. The latter is an organic substance combined with nitrogen and iodine (10 per cent.). Clinical observations show that thyro-iodine is very active, patients suffering from goitre and myxœdema having been cured by it. Baumann maintains that the entire active substance remains on the filter after coagulation of the albumin. Baumann (Zeit. f. physiol. Chem., B. 21, pp. 319 and 481, '96).

The colloid material, believed by Hutchinson to be the active ingredient of the thyroid gland, has been found to contain iodine in organic combination,

the colloid matter owing its activity to the presence of this organic compound of iodine.

> The proteids of the gland are two in number: 1. A nucleo-albumin present in small amount and probably derived from the cells lining the acini. 2. The colloid matter, made up of a proteid and a non-proteid part, the latter containing, in all probability, Baumann's throidin. Certain extractives are also obtained from the gland, as creatin, xanthin, etc., which have been found absolutely inert when administered either to healthy persons or to cases of myxœdema. The same result obtained on giving the nucleo-albumin. The pure colloid matter gave the ordinary signs of thyroid activity in healthy individuals, and in large doses distinct thyroidism resulted. Marked beneficial results were obtained on administering it to a patient with myxœdema. The proteid and the non-proteid constituents of the colloid were then given separately, and although benefit resulted from the former, yet the most favorable results were obtained from the administration of the latter. Robert Hutchinson (Brit. Med. Jour., Jan. 23, '97).
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> The colloid substance is the active secretion of the thyroid gland, and is made up of thyreoglobulin and nucleoproteid. Experiments were undertaken to show the influence which thyreoglobulin and nucleoproteid exercised upon general metabolism. Results showed that in the case of dogs the excretion of nitrogen was considerably increased when thyreoglobulin was given, whereas nucleoproteid had no effect upon the output of nitrogen.
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> Thyreoglobulin is the most active body in the thyroid gland; it contains all the iodine, and the amount of iodine increases *pari passu* with the increased colloid material; it therefore follows that thyreoglobulin is contained in the colloid material. Oswald (Hoppe-Seyler's Zeit. f. physiol. Chemie, vol. xxvii, Parts 1 and 2, '99).

Thyro-antitoxin is the provisional name of another active principle, obtained by Fraenkel, from the thyroid gland of the sheep. It exerts no influence on nutrition comparable with that of fresh thyroid or thyro-iodine.

> The albuminous bodies were precipitated by acetic acid, and by feeding experiments it was ascertained that the precipitate had no marked effect, while the filtrate that was obtained possessed the well-known properties of the thyroid gland, or, in other words, contained the physiological active principle. Fraenkel (Wiener med. Bl., S. 48, '95).
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> In the tetanic condition toxins are found in the blood which are rendered innocuous by the thyro-antitoxin of Fraenkel, formed in the gland-alveoli. In the myxœdematous condition, on the contrary, a "thyroproteid" is formed in the tissues, passes into the blood, and is fixed by the thyroid. Here it is rendered innocuous by an enzyme which splits it up into two parts: a proteid constituent, which unites with thyro-iodine, and the other a carbohydrate. Notkin (Virchow's Archiv, Suppl., B. 144, '96).

Preparations. — The implantation of a portion of the thyroid gland beneath the skin was soon superseded by the hypodermic method, but the latter presented another drawback, that of requiring the constant attendance of the physician. Besides this the preparations often produced suppuration. The gland itself, therefore, administered in the form of desiccated powder in tablets or capsules, is preferred by the majority of practitioners.

> It seems evident, all in all, that the entirely unobjectionable whole gland prepared in desiccated powder or capsule or in compressed tablet is the only means by which we ought to attempt to treat conditions in which this animal substance has been found useful. Editorial (Ther. Gaz., May 15, '97).

The glands of young sheep have given the best results. When the glands themselves are to be administered, considerable

care should be taken, and they should be obtained through a veterinary surgeon. Again, the glands should be carefully examined to ascertain that they are not diseased.

> Over 50 per cent. of sheep's thyroids examined showed more or less evident indications of deviation from the normal. Emphasis on the need of care in the selection of glands for administration. A. Napier (London Lancet, Feb. 4, '93).
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> It is usually advisable for the doctor himself to get the thyroid lobes. If it is left to the butcher quite other substances may be supplied. The glands of sheep, and especially of young sheep, are to be preferred, tuberculosis being extremely rare in this animal. The sheep has two thyroid bodies, one on each side of the trachea. The upper part of each thyroid corresponds exactly to the track of the butcher's knife in bleeding the animal; the top of the gland is almost always cut by the knife, and this forms a good guiding mark for finding the gland at once. Gabriel Gauthier (Lyon Méd., June 27, July 11, '97).

The thyroids should be removed as quickly as possible after the animal is killed. After careful antiseptic preparation of the field of operation, the glands should be dissected out with aseptic instruments, and after removing all the fat and connective tissue they should be put into a sterilized, covered glass dish which has been previously weighed. The organs, as soon as secured, should also be taken to the laboratory and weighed. They are then cut into small pieces with aseptic scissors and double their weight is added of a mixture containing 2 parts of glycerin and 1 part of sterilized water. After standing in this for twenty-four hours, they are poured into a suitable bottle, which is stoppered with cotton and sterilized. The extract thus obtained is poured into small sterilized bottles and will keep for a considerable time.

Of the extracts containing 20 per cent. of the thyroid gland, 1 drachm per week may be given, and of the thyroid glands themselves 1 lobe: that is, one-half of the entire gland. The latter may be administered chopped finely and cooked, or it may be macerated after chopping in a small quantity of water, and the extract thus obtained given in beef-tea without cooking. Broiled slightly, the natural juices of the thyroid are less altered when administered.

A powder may be made by separating the gland from all foreign tissues and, after chopping finely, desiccating at a low temperature to avoid cooking. The objection to this method is that the powder has an unpleasant odor, which, however, may be disguised by mixing with cacao and administering in pill form; 8 pills, of $^{5}/_{6}$ of a grain each, are given daily. This amount is nearly equivalent to one lobe of the thyroid. This powder may also be dispensed in tablets or inclosed in gelatin capsules.

If small quantities have to be administered, owing to antagonism on the part of the patient, etc., Murray's method may be used. The gland is cut into small pieces, and macerated in an equal amount of glycerin, the extract being obtained by pressure and filtration and administered in drop doses. The dose is four times that employed in hypodermic medication.

> The action of the thyroid gland is to convert the salts of iodine, which are present in the blood, into iodothyrin. It would therefore seem advantageous to administer iodothyrin in place of thyroid extracts. De Cyon (Med. News, Oct. 1, '98).
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> Aïodine is a new preparation obtained by precipitating with tannin the iodo-albuminates: the bases and the mucous substance of the thyroid gland. Fifteen grains of aïodine correspond to one hun-

dred and fifty grains of fresh, or three hundred grains of desiccated, thyroid gland. Schoerges (Nouveaux Remèdes, Aug. 24, '98).

New preparation, aiden, a precipitate from a solution of thyroid in normal salt by means of tannin. It contains a greater number of the extractive principles of the gland than have hitherto been obtained, as shown by experiments on animals. Jaquet (Correspondenzblatt f. Schweizer Aerzte; Med. News, June 10, '99).

The fresh gland furnishes 20 per cent. of extract or 27 to 28 per cent. of dry powder. The powder is employed in tablet form, in the dose of $^5/_6$ of a grain.

A powder that will keep for a long time may be prepared in the following manner: After an aseptic removal of the glands, and removing all foreign tissues, pulpify and mix them with the biborate of soda and powdered charcoal. In this manner is obtained a dry powder, which is put in capsules, each containing $1\,^2/_3$ grains of the extract. This preparation, when not exposed to heat, is not altered. Vigier (Archives de Neurol., Mar., '96).

A preparation that will also keep a long time is the following: Immediately after the death of the animal the gland is excised under all aseptic precautions, all extraneous tissues are removed, and the gland is powdered with boric acid. When a sufficient number have been prepared they are taken to the laboratory, cut up, and triturated with sugar and an additional amount of boric acid. The sugar absorbs the juices, and the resulting mixture is almost free from liquid. This mixture is desiccated at a temperature of 86° C., and divided into small masses, which are coated with gelatin, each mass containing about $1\,^2/_3$ grains.

Each lobe of the thyroid produces about 26.8 per cent. of powder; three capsules are therefore equivalent to one lobe of the gland, or the therapeutic unit. (Yvon.)

The thyroid extracts prepared by the pharmaceutical chemists of the United States offer a convenient form of administration.

Untoward Effects and their Prevention.—The dangers attending the use of thyroid preparations depend, to a degree, upon the manner in which the remedy is administered. When the pure gland is used, the physiological phenomena caused by an overdose will show themselves,—namely: a weak, rapid pulse and shortness of breath; vomiting, cardiac oppression, a feeling of tightness around the chest, vertigo, and coma. When dried powder or compressed tablets are used symptoms of ptomaine poisoning may be added to those mentioned.

Too great an increase in the pulse-rate and vomiting are signs that the patient is getting too much. H. W. G. Mackenzie (Centralb. f. Nerv. Psy., July, '93).

In giving thyroid preparations, the best guide is the pulse. Any considerable quickening or palpitation should lead us to discontinue the drug until the cardiac action is again normal. There are no dangers in the use of the drug, provided we begin with small doses, from 1 to 2 grains of American extracts, and gradually increase, watching the pulse. It should never be given to a patient who cannot be closely watched. R. C. Cabot (Med. News, Sept. 12, '96).

Case in which a man took for obesity nearly 1000 5-grain tablets of thyroid extract within five weeks. After the first three weeks he began rapidly to develop the symptoms of acute Graves's disease. When thyroid was stopped and patient was put upon arsenic all the symptoms disappeared quickly, excepting the eye changes and the goitre, which were still notable for about six months. A. V. Notthaft (Centralb. f. innere Med., Apr. 16, '98).

Among the less active symptoms are anorexia, diarrhœa, malaise, lassitude, and pain in the extremities; headache, increase of urine, rise of temperature, various eruptions, urticaria, transient and papular erythema and eczema, and, in some cases, nervous manifestations: neuralgia, delirium, convulsions, delirium of persecution, aphasia, monoplegia, etc.

> Some of the discomforts of treatment are a feeling of tightness in the chest, with itching, burning, and other abnormal sensations in the skin, and a sense of weakness. G. Stewart (Practitioner, July, '93).
>
> Thyroid powder, when given subcutaneously, also produces a rise of temperature. It is a pyrogenic agent. This action of the thyroid shows that we should be careful in its administration to persons affected with heart disease. Isaac Ott (Med. Bull., Oct., '97).
>
> The drug is badly tolerated by general paralytic and tuberculous patients, still worse by patients over 60 years of age, and worst of all by fat patients, especially those in whom there is reason to suspect fatty degeneration of the heart. C. C. Easterbrook (Lancet, Aug. 27, '98).

Among the early warnings obtainable when large doses are being administered is *undue* loss of weight.

> Loss of weight is an early sign of improvement, which sometimes goes beyond the requirements of health. Rise of temperature and pulse, increase of urine, faintness, headache, prostration, cardiac weakness, and neuralgic pains have been observed during treatment. J. J. Putnam (Amer. Jour. Med. Sci., Aug., '93).
>
> It is a powerful remedy, and must be used with caution. A daily dose or one every second day may be sufficient. One-half to 1 grain to children and 5 to 10 grains to adults personally given. J. H. Musser (Inter. Med. Mag., Nov., 1900).

When the preparation of thyroid first employed tends to give rise to untoward effects, a change of preparation is sometimes sufficient.

> Case in which the glycerin extract of thyroid could not be taken, even in small doses, without the production of very distressing symptoms, while the powdered extract was well borne. J. M. Anders (Med. News, June 12, '97).

If even then the preparations are not borne, portions of the gland or glandular extract may be administered by the rectum. The extract, as shown by Lépine, can also be injected into the rectum.

According to Mackenzie, inunctions of a thyroidin ointment prepared as shown below may be employed.

> When patients cannot bear even very small doses of thyroid, twice a day, after hot sponging and vigorous rubbing, the body is well anointed with the following mixture:—
>
> ℞ Thyroidin, 10 parts.
> Ether, 60 parts.
> Lanolin, 480 parts.—M.
>
> A rise of temperature of one degree followed the inunction. The process was well borne and followed by satisfactory results. E. Blake (Prov. Med. Jour., Sept. 1, '94).
>
> Arsenical preparations antagonize thyroidal intoxication through the energetic restraining influences of arsenic upon oxidation processes. They diminish the palpitation of the heart without in any way interfering with the other good influences of the thyroid gland. Experiments upon dogs and rabbits to which were administered thyroid gland and Fowler's solution and several cases showed that it was possible to push the thyroid gland in ascending doses more rapidly and with better effect when arsenic was given than without it. Mabille (Les Nouveaux Remèdes, May 8, '99).
>
> Mabille's observation confirmed that arsenic obviates the unpleasant symptom excited by thyroid preparations. In 5 cases of idiopathic goitre, in a case of obesity, and 1 of infantile myxœdema, iodothyrin was given in progressive doses

of from 3 4/5 to 30 or 38 1/2 grains daily. At the same time arsenic was given, either in pills or as Fowler's solution, in doses increasing proportionately to the iodothyrin of 1/64 to 1/10 or even 1/8 grain daily. The results fully confirmed Mabille's experience, for, though the 7 cases took respectively 231, 111, 86, 320, 108, 296, and 125 iodothyrin tabloids, containing nearly 4 grains each, beyond occasional increased frequency of the pulse no symptoms of thyroidism appeared, so that the course could be continued uninterruptedly. Arsenic, therefore, appears to suppress thyroidism with greater certainty than atropine does iodism, and it is now possible to give iodothyrin safely in doses and for a period capable of producing definite therapeutic effects. Ewald (Die Therapie der Gegenwart, Sept., '99, and Med. Review, Dec., '99).

As noted in cases treated by Stabel, thyroid gland is likely to cause gastric disturbance most frequently during warm weather. He found that this could be avoided by preserving the glands or their preparations on ice, when they were not to be used at once.

According to Lanz, the danger consists more in the extreme alterability of the products than in the toxicity of their active principles. A series of experiments showed that 9 grains of the English thyroidin, dried by the ordinary procedures, gave rise to tachycardia, whereas the absorption of from 5 drachms to 1 ounce of raw fresh thyroid gland did not give rise to any disturbance. Examination of pastilles, tablets, tabloids, capsules, etc., revealed bacteria, including even the septic vibrio, ptomaines, etc.

Gastric digestion, as shown by Howitz, in no way modifies the properties of the glands. Maurange has obtained a peptone which can be kept indefinitely either in the dry state or in a syrupy condition with the addition of an equal quantity of glycerin and alcohol. It may be given in wine or sweetmeats containing 50 per cent. of sugar. The author has used these peptones, named by him peptothyroidin, peptovarin, peptomedullin, etc., for fifteen months and though still very imperfect and prepared only as needed, they have been perfectly tolerated even by confirmed dyspeptics.

As to the use of any of the active principles described, clinical results have not sufficiently sustained the theoretical views concerning their actual worth to warrant a wholesale recommendation of them. Again, physiological investigations have seemed to suggest that their influence upon general metabolism is different from that exercised by the complete gland. Still, in a few instances, excellent results have been obtained from them and further study will doubtless make it possible to isolate an active principle devoid of useless and perhaps harmful elements. For the present, therefore, the gland itself or prepared in desiccated powder or capsule or in compressed tablet should only be employed.

A promising agent is Robert Hutchinson's colloid. Here, however, the inert extractives removed are mere foreign bodies, the colloid itself being a composite proteid containing various active elements, including, probably, Baumann's thyroidin. We are not dealing, therefore, with an active principle *per se*, but, in reality, with the active part of the gland. The advantages claimed for colloid are: 1. A constancy of dose is insured. The quantity of colloid in different glands varies considerably; hence the amount of active substance in dried preparations of the whole gland is really not constant. 2. The drug is quite pure. 3. The pure colloid is free from taste and odor, and keeps indefinitely. 4. A very small dose is required. 5. The colloid is absorbed with great ease and ra-

pidity. 6. The administration of the colloid matter is really the most economical way of giving the thyroid. There is no waste of active material, as occurs in the preparations of thyroidin.

Therapeutics.—The diseases in which thyroid gland and its preparations are utilized are so numerous that a general review of the results obtained would afford but little information. The various disorders, including the clinical data collated upon each, are therefore presented separately, and in alphabetical order.

The thyroid extract is a powerful alterative. Its use is likely to be of service, however, only in those diseases which are in some way related to partial or total suspension of the thyroid function. Its action is almost specific in myxœdema, sporadic cretinism, and the cachexia which follows the extirpation of the thyroid gland. Its use in insanity is in some degree justified rationally on the ground that in that disease altered glandular action and disordered metabolism are almost universally found.

Thyroid is a constant ingredient in antifat remedies, and M. Porges has made extensive experimentation in this regard. He finds that the majority of cases show no improvement whatever, while the few, and those are those cases which readily show the physiological action of the remedy, experience some benefit. He thinks that in these cases the fatness, in some measure at least, is due to the defective action of the thyroid gland, and hence the exhibition of the thyroid extract is highly rational. On the whole, he condemns its use in this class of patients, as the benefits derived are not worth the hazard undergone while taking the treatment.

It has been tried in many forms of skin diseases, both internally and as a local application. The results reported are variable. Scleroderma, psoriasis, eczema, and ichthyosis are said to do well occasionally, and of late very encouraging reports of it have been noted in stubborn cases of diffuse eczema. Externally, it has been tried in various forms of chronic ulcer, but the reports of results have not been such as to show that it had any special value for this purpose. De Lace reports a case of severe purpura in which thyroid effected a complete cure.

As an emmenagogue it has repeatedly succeeded when other means had failed, but, when given for this purpose solely, it seems to be useless. In cases of insanity where the menstrual function was in abeyance, when the remedy ameliorated the patient's general mental and physical condition, return of the menses was among the other signs of improvement, but in no case was menstruation re-established as the only apparent result of the treatment. In exophthalmic goitre, with or without mental symptoms, it seems to be positively harmful. Hiram Elliott (Brooklyn Med. Jour., April, 1901).

Arrested Growth. — In the treatment of dwarfing thyroid extract has been found to be of great value, whether the condition be associated with idiocy or not. The observations of Virchow, in 1883—to the effect that rachitis, cretinism, and dwarfing were dependent upon disease of the thyroid gland, fully supported by experiments showing that thyroid feeding was capable of restoring normal growth when the latter had been arrested by thyroidectomy—pointed distinctly to thyroid as a valuable remedial agent. More recent experiments have further sustained this view and shown that the leanness attending rapid growth in youths could be attributed to an exaggerated activity of the thyroid gland.

Effect of thyroid in children and youths who, although not cretins, were backward in growth. In 6 of these cases, in which the arrest of growth was due either to chronic albuminuria (2), rickets (2), masturbation (1), or congenital debility (1), there was a renewal of active growth,—in some very considerable. E. Hertoghe (Bull. de l'Acad. Royale de Méd. de Belgique, '95).

In three cases of myxœdematous idiots, aged from 14 to 30 years, the striking points were growth and a loss of weight. In three other cases of obesity in idiots the growth under treatment was proportionately more in four, five, or six months than the average growth of the eighteen untreated imbeciles or epileptics during their tenth, eleventh, and twelfth years, which were taken as more nearly approaching normal children to control these experiments. Bourneville (Progrès Méd., Feb. 1, '96).

The rate and amount of the increase in height is in inverse ratio to the age of the patient and to the stage of the treatment. Thus, children grow more than adolescents, and adolescents more than adults; the rate of growth is at first very rapid, but becomes slower as the height approaches that of the normal for the age. John Thomson (Brit. Med. Jour., ii, 615, '96).

Number of recorded examples of dwarfing associated with atrophy of the thyroid gland cited. Experiments on animals corroborate the idea of a direct connection between the two conditions. Four cases in which thyroid treatment was resorted to to overcome dwarfing in children, in which normal height was reached. J. J. Schmidt (Therap. Woch., Nov. 15, '96).

In nine cases, including four idiots, large doses of sheep's thyroid (half a lobe every day or every second day) given. The way most of them gained in height was most remarkable. In one the gain amounted to $2\,^{2}/_{5}$ inches in five months. Boullenger (Pediatrics, Mar. 15, '97).

Case of cretinism in which patient was 30 years of age, and resembled a child of 7 or 8 years as to height. Under thyroid extract improvement was marked, in $2\,^{1}/_{2}$ years the increase in height being 7 centimetres. W. Sinkler (Phila. Med. Jour., May 7, '98).

CRETINISM.—Clinical and experimental evidence have demonstrated that absence or impotence of the thyroid gland, as a result of insufficient development, removal, or neoplastic overgrowth, leads to a general condition at least closely allied to that witnessed in cretinism, while symptoms of myxœdema are preeminent in the majority of cases. That much was expected from thyroid as a remedial agent need hardly be emphasized.

It may be said that the hopes entertained have been fully realized. The mental condition is greatly improved and the stunted growth is counteracted. As the patient approaches the height normal to his age the growth continues at the normal ratio. The myxœdematous symptoms are rapidly removed, the abnormal appearance being thus in great part corrected. If begun early in the disease and continued systematically, the treatment seems capable of finally restoring the patient to a comparatively normal condition.

In a recent paper Osler was able to collect sixty cases of sporadic cretinism which had been observed in America, demonstrating that the disease is not limited to European countries, as thought by many.

Case of cretinism in which mental as well as physical condition improved. Immediately upon the exhibition of the remedy and at the close of the first week a decided decrease in weight was observed. At the end of the first two months he had lost twenty-two pounds and gained over an inch in height. General condition, physical as well as mental, has considerably improved. H. H. Vinke (Med. News, Mar. 21, '96).

Cretin child under treatment by thyroid about two years in an intermittent and rather unsatisfactory manner, afforded clear proof of the value and potency of the treatment. Every time it was begun the child underwent a rapid and striking improvement; every time the treatment was neglected the child relapsed into its former cretinoid appearance, although it never became so bad as it was at first. Finlayson (Glasgow Med. Jour., May, '96).

TABLE OF PUBLISHED CASES OF CRETINISM TREATED BY THYROID ADMINISTRATION.

Found in Literature up to May 1, 1896, by Frederick Peterson and Pearce Bailey (Pediatrics, May 1, '96).

AUTHOR AND REFERENCE.	SEX.	AGE AT BEGINNING OF TREATMENT.	DURATION OF DISEASE.	SYMPTOMS.	DURATION OF TREATMENT.	CHARACTER OF TREATMENT.	RESULTS.
Robin. Lyon Méd., 1892, lxx, p. 405.	F.	7 yrs.	Congenital.	Characteristic. Unable to walk or talk.	Not stated.	Extract followed by implantation.	Complete change in appearance. Walks.
Carmichael. Lancet, 1893, i, p. 580.	F.	8½ yrs.	Congenital (?).	Characteristic appearance. Intelligence limited. Unable to walk or talk.	9 mos.	Hyp. inject. of extract and feeding of raw gland.	Skin became normal. Learned to walk and run. Intelligence improved.
Evans. Br. Med. Jour., 1893, i, p. 767.	M.	8 yrs.	Not stated.	Not stated.	6 weeks.	One lobe of sheep's thyroid twice a week.	No improvement.
Hellier. Lancet, 1893, ii, p. 1117.	F.	2⅓ yrs.	1–2 yrs. (?).	Characteristic appearance. Unable to walk or talk. Idiotic.	4½ mos.	Extract.	Œdematous symptoms gone. More intelligent. Cannot walk or talk.
Lunn. Br. Med. Jour., 1893, p. 1273.	F.	26 yrs.	Not stated.	Idiotic. No other details.	Not stated.	Not stated.	Became relatively intelligent and menstruation was resumed.
Ord. Lancet, 1893, ii, p. 1113.	F.	6½ yrs.	Congenital (?).	Characteristic appearance. Could not walk or talk.	8 mos. (?).	Had been grafted previously with temporary benefit. Raw gland and extract.	Great improvement. Learned to walk in three months. Can talk.
Ibid.	M.	3 yrs.	Congenital (?).	Could not talk. Always dwarfed and bow-legged. Skin dry.	8 mos. (?).	Raw gland, dried gland, and extract.	Marked. Learned to talk. Growing rapidly.
Ibid.	M.	9 mos.	Not stated.	Typical.	. . . . .	. . . . .	Improved rapidly, but died of intercurrent diphtheria.
Ibid.	M.	9½ yrs.	In infancy.	Characteristic physically, but intelligent. Height, 34 in. Could walk.	8 mos. (?).	Compressed extract.	Grew 1½ inches in four months. Improvement in other respects not so marked.
Owen. Br. Med. Jour., 1893, p. 1273.	F.	26 yrs.	In infancy.	Characteristic. Height, 40¼ in.	. . . . .	Tabloids.	Improvement.
Patterson. Lancet, 1893, ii, p. 1116.	M.	19 mos.	12 mos. (?).	Characteristic.	8 mos.	Extract.	Œdematous symptoms gone. Can stand. Learning to talk. Has sixteen teeth.
Vermehren. Deut. med. Woch., 1893, p. 256.	F.	29 yrs.	24 yrs.	Characteristic.	3 weeks.	Thyroidin.	Marked improvement.
Wood. Aust. Med. Jr., 1893, p. 166.	F.	1 yr. 11 mos.	. . . . .	. . . . .	1 mo.	Had been grafted. Raw gland.	One month's feeding without benefit.

TABLE OF PUBLISHED CASES OF CRETINISM TREATED BY THYROID ADMINISTRATION.
(*Continued.*)

AUTHOR AND REFERENCE.	SEX.	AGE AT BEGINNING OF TREATMENT.	DURATION OF DISEASE.	SYMPTOMS.	DURATION OF TREATMENT.	CHARACTER OF TREATMENT.	RESULTS.
Rehn. Ver. der XII Cong., 1893, p. 224.	F.	4½ yrs.	Not stated.	Characteristic.	2 mos.	Extract.	Marked improvement.
Ibid.	F.	6½ yrs.	Not stated.	Characteristic.	2 mos.	Extract.	Marked improvement.
Anson. Lancet, 1894, i, p. 1063.	F.	10 yrs.	Congenital.	Characteristic appearance. Could walk clumsily. Mental process slow.	1 yr.	Raw gland and glycerin extract.	Œdematous symptoms gone. Intelligence improved. Grew 4 in. (For three years previously had grown only 2 inches.)
Bramwell. Br. Med. Jour., 1894, i, p. 6.	F.	16¼ yrs.	Not stated.	Typical. Idiotic. Height, 29½ in.	6 mos.	Extract and tabloids.	Œdematous symptoms disappeared. More intelligent. Grew 6½ inches.
Comby. Méd. Enfant., 1894, i, p. 578.	F.	2 yrs.	6 mos.	Characteristic appearance. Cannot walk or talk.	15 days.	Raw gland.	Improvement.
Crary. Am. Journal Med. Sciences, 1894, p. 529.	F.	5 yrs.	3 mos.	Characteristic appearance. Dwarfed, lordosis, impaired intelligence.	2½ mos.	Extract.	Great improvement mentally and physically.
Garrod. Br. Med. Jour., 1894, ii, p. 1112.	F.	8½ yrs.	Not stated.	Characteristic.	1½ yrs.	Not stated.	Lost cretinoid appearance. Grew 5 inches.
Lendon. Aust. M. Gaz., 1894, p. 154.	F.	12 yrs.	Not stated.	Height, 32 in. Weight, 25 lbs. Loss of sphincteric control.	17 days.	Hypodermic injections of extract.	Improvement—then fever, bronchitis, and death.
Ibid.	F.	18 yrs.	Not stated.	Height, 3 ft., 3¾ in. Growth in six years only 2¾ in.	9 mos.	Not stated.	Grew 4⅜ inches.
Northrup. N. Y. Medical Jour., 1894, 60, p. 505.	F.	9 yrs.	8 yrs.	Characteristic. Idiotic.	80 days.	Extract.	Much improved.
Ibid.	Not stated.	12 yrs.	Not stated.	Characteristic.	Not stated.	Not stated.	Results not marked.
Osler. N. Y. Medical Jour., 1894, 60, p. 505.	M.	3 yrs.	Not stated.	Characteristic. Could not walk or talk.	14 mos.	. . . . .	Œdematous symptoms all disappeared. Walks and talks. Grew 4 inches.
Ibid.	M.	19 yrs.	Not stated.	Not stated.	. . . . .	Treatment not systematically carried out.	No material gain.
Railton. Br. Med. Jour., 1894, i, p. 1180.	M.	14 yrs.	Not stated.	Characteristic. Idiotic. Height, 33 in.	11 mos.	Raw gland and tablo.ds.	Œdematous symptoms disappeared. Cannot talk well. Grew 3 inches.

TABLE OF PUBLISHED CASES OF CRETINISM TREATED BY THYROID ADMINISTRATION.

(*Concluded.*)

AUTHOR AND REFERENCE.	SEX.	AGE AT BEGINNING OF TREATMENT.	DURATION OF DISEASE.	SYMPTOMS.	DURATION OF TREATMENT.	CHARACTER OF TREATMENT.	RESULTS.
Smith. Br. Med. Jour., 1894, i, p. 1178.	M.	9 yrs.	7 yrs.	Not a severe case.	9 mos.	Raw gland and tabloids.	Improvement.
Thomson. Edin. Medical Jour., 1894, Feb., p. 720.	M.	18 yrs.	16 yrs.	Characteristic. Mind that of a child of 3 years. Height, 33½ in. Waddling gait.	12 mos.	Raw gland.	Some toxic symptoms. Skin grew softer and mind became brighter. Grew 4¾ inches. Most improvement at first.
Escherich. Wien. med. Woch., 1895, p. 350.	F.	6¼ yrs.	[illegible] yrs.	Myxœdematous symptoms not marked. "A backward child."	6 mos.	Raw gland of calf.	Grew 13 centimetres.
Lebreton. Gaz. Méd. de Paris, 1895, No. 1, p. 8.	M.	13 yrs.	12 yrs.	Characteristic. Idiotic.	Not stated.	Raw gland, slightly browned.	Dentition appeared. Growth resumed. Nothing said of intelligence.
Lebreton. Gaz. Méd. de Paris, 1895. No. 3, p. 31.	M.	3 yrs.	1 yr.	Characteristic.	1 yr.	Dried gland.	Improved.
Sinkler. Int. Medical Mag., 1894–'95, iii, p. 785.	F.	4 yrs.	3½ yrs.	Characteristic. Unable to walk, talk, or understand. Height, 30¼ in.	3 mos.	Extract.	Œdematous symptoms mostly disappeared. Became more intelligent and began to talk. Grew 2¼ inches.
West. Arch. of Ped., 1895, p. 348.	F.	17 mos.	Congenital.	Stupid. Height, 23¾ in. Weight, 14½ lbs. No teeth.	6 mos.	Desiccated extract. Glycerin extract.	Œdematous symptoms disappeared. Eight teeth. Grew 4 inches. Intelligent.
Fruitnight. Arch. of Ped., 1896, p. 143.	M.	4 yrs.	3 yrs.	Cannot walk or talk. Height, 25 in. Weight, 16½ lbs.	1 mo.	Dried gland.	Grew thinner and more intelligent.
Noyes. N. Y. Medical Jour., 1896, 68, p. 331.	F.	2 yrs.	1 yr., 10 mos.	Characteristic. Height, 24 in.	4½ mos.	Tablets.	Œdematous symptoms gone. Intelligence improves. Begun to creep. Grew 8 inches.
Parker. Br. Med. Jour., 1896, i, p. 333.	F.	6½ yrs.	Congenital (?).	Typical.	12 mos.	Tabloids.	Œdematous symptoms disappeared. Learned to walk. Did not learn to talk.
F. Peterson and P. Bailey, Ped., May 1, '96.	M.	18 mos.	(?)	. . . . .	10 mos.	One grain extract daily.	Probably cured.
Ibid.	F.	10 yrs.	(?)	. . . . .	3 mos.	One grain extract daily.	Great improvement.
Vinke. Med. News, 1896, 68, p. 309.	M.	6 yrs.	Congenital	Characteristic appearance. Can walk and talk a little.	5 mos.	Tablets.	Marked improvement in all symptoms.

Case of a cretin, nearly 18 years old, so stunted as to be easily mistaken for a child aged 2 or 3 years; she could not stand or walk or speak. On October 15th she began taking half of a 5-grain thyroid tabloid daily, and within the first week she became much brighter and quicker in noticing things; she also lost one and three-fourths pounds. During the second week she lost two pounds more; made very ill, hot, feverish, restless, parched, and thirsty. During the third week she lost one and one-half pounds more, and became still brighter and quicker. Both physical and mental improvement during the first six months. W. Rushton Parker (Brit. Med. Jour., June 27, '96).

Case of a child, 5 years of age, seven inches below the normal height at the beginning of treatment, who grew five and three-fourths inches in the first year of treatment, four and one-fourth inches in the second year, and two and one-half inches in the third year. In two adult cretins, 36 and 39 years of age, the growth in one was three-fourths of an inch and five-eighths of an inch in the first and second years, and none in the third. J. Thomson (Brit. Med. Jour., vol. ii, p. 618, '96).

Cretins whose bones show signs of softening should be kept lying down as they would be in ordinary rickets. Victor Horsley (Brit. Med. Jour., Sept. 25, '96).

During thyroid treatment the rapid growth of the skeleton leads to a softened condition of the bones, which results in a yielding and bending of those which have to bear weight; as cretins under treatment become more active and inclined to run about, this tendency to

Case of typical sporadic cretinism. Appearance when treatment was begun. After eighteen months' treatment he had grown nine inches and the mental condition had improved correspondingly. (*Vinke.*)

bending has to be guarded against. If any bending of the bones of the legs appears, the child should not be allowed to walk for a time, or the legs should be supported by light splints. The diet should be generous, and the child should get plenty of sunlight and open air. The administration of codliver-oil and Parrish's food would probably prove beneficial at the same time. T. Telford-Smith (Lancet, Oct. 2, '97).

Case in which all the symptoms of infantile myxœdema were present: idiocy, dwarfism, absence of the thyroid gland, retarded dentition, pachydermic dentition, etc. Effects of thyroid treatment remarkable. Suspension of treatment: reappearance of almost all symptoms. Treatment was resumed and child transformed physically and intellectually. Bourneville (Le Prog. Méd., Mar. 6, '97).

Three cases improved markedly after taking thyroid three times a day in 1-grain doses; they could be classed with those mentioned by Horsley as being born with but few, if any, signs of the disease, and who gradually become cretins. M. H. Fussell (Med. and Surg. Reporter, Feb. 20, '97).

Three cases in two brothers and sister. The two older marked cretins, the younger being quite a typical case, while the baby has the cretinoid tendency well marked. Thyroid treatment instituted. The baby's present condition is quite that of a normal child. The cases of the two older are less promising as to final results, although they have shown improvement in many ways. C. S. Caverly (Med. Record, Apr. 10, '97).

Fig. 1.

Fig. 2.

Cretin nearly 18 years of age. Fig. 1. Before treatment. Fig. 2. Six months after treatment by thyroid extract. (*Rushton Parker.*)

Four cases of cretinoid myxœdema in which thyroid extract in small doses ($2\frac{1}{2}$ grains twice a week) was used with success. It is a great deal better to begin with small doses two or three times a week, even if the desired results are obtained more slowly, than to deluge the patient with it. J. C. Shaw (Brooklyn Med. Jour., Jan., '97).

Case of a child, nearly 8 years old, typical of cretinism, put under desiccated thyroid $1\frac{1}{2}$ grains t. i. d., but, the remedy being administered irregularly, the patient was taken into a hos-

pital. It was then found that 6 grains daily was her maximum dose, and on this amount she very rapidly improved. At the end of four months (seven from the beginning of treatment) she had gained four inches in height, four pounds in weight, and had begun to act like a normal child. Dickson L. Moore (Columbus Med. Jour., Apr. 13, '97).

Case of advanced cretinism in Hindoo boy treated by thyroid extract. Thyroid treatment was begun by administration of 3 grains of the dry extract by the mouth daily. Thyroid enlargement diminished fully two inches in the space of one month; the lad, both physically and mentally, had shown marked improvement. Dose increased to 5 grains daily. Marked and steady improvement continued, but marked absence of patellar reflex: a prominent symptom in tabes dorsalis, in which Brown-Séquard has used orchitic fluid. Administered to patient 5 grains of didymin daily, as well as the thyroid extract. After a fortnight signs of the reflex returned; patient became much stronger on his legs. H. E. Drake-Brockman (Lancet, Oct. 2, '97).

Case of a child who presented a typically cretinoid appearance when first seen in February, 1896, then 5 years old. Mentally deficient. Given one 5-grain tabloid of thyroid extract (Burroughs, Wellcome & Co.) daily, which raised the temperature to 102° F.; dose reduced to one-half. Gradual improvement. Weight fell at first to twenty pounds, and then slowly increased, the cretinoid aspect disappeared, and the intelligence steadily improved. Continued to take smaller quantities of the extract, and has developed into a healthy child, weighing thirty-seven pounds, and measuring thirty-seven and one-half inches in height. No thyroid gland could be detected on palpation. W. Carr (Brit. Med. Jour., Nov. 13, '97).

Fig. 1.

Fig. 2.

Case of cretinism. Result of four months' treatment. Growth, 4 inches. Intellect approaching normal. (*Moore.*)

Case of a girl, aged 10 years, who first came under observation in June, 1897, and had not previously been treated with thyroid gland. She was then 9 1/2 years old, weighed thirty pounds, and was two feet and ten inches in height; legs short, with lordosis and prominence of the abdomen. She was in the second standard at school. During four months of thyroid treatment grew two and one-half inches, fatty masses disappearing from her neck. Expression lively and intelligent. W. S. Coleman (Brit. Med. Jour., Nov. 13, '97).

Case with numerous abscesses which healed as soon as the child was put under the thyroid treatment. Hæmoglobin increased from 25 to 75 per cent., child not having done well on the daily doses of from 1/4 to 1/2 grain of the thyroid extract, this attributable not only to the small doses of the thyroid, but to the use of a bad preparation.

Case, in which cold hands showed weak circulation, greatly improved when the preparation was changed. It seemed that the dose must be increased as the child grew older. These children should be kept upon the largest doses of thyroid they will stand without having an elevation of temperature. H. Koplik (Pediatrics, Nov. 15, '97).

Case of cretinism, after two years of treatment, very remarkably improved. During the first year of treatment an attempt was made to keep the child on as large a dose of the thyroid extract as possible. It was found after trial that the child did best on 1 grain a day. After nine months 1 1/2 grains (Parke, Davis & Co.), twice a day. During the first year of treatment she grew eight and one-fourth inches and gained fourteen pounds: *i.e.*, nearly doubled her weight. After she had been under treatment a year the thyroid was stopped, and during that time the peculiar appearance of the cretin returned and she became much more stupid. She was then put back on 1 1/2 grains a day, and this was kept up until the first of this year. Since then she has had 1 1/2 grains twice a week, on alternate weeks. J. P. West (Pediatrics, Nov. 15, '97).

In sporadic cretinism the fresh thyroid gland, the desiccated gland, and even the colloid substances have been found almost equally efficacious. The preparation used should be free from decomposition-products. Half a grain of the desiccated gland may be at first given two or three times a day, the dose increased in a week or two to 1 grain, and later this may be increased if improvement is not satisfactory. If unpleasant effects result, the dose should be lessened or a fresh preparation tried. A. McPhedran (Canadian Jour. of Med. and Surg., vol. iv, p. 275, '98).

Mental Development Following Treatment with Thyroid. — The alteration in the mental condition is noticed within a couple of months. The patients look much brighter and the face is not absolutely expressionless. As a rule, the younger the case, the more marked is the mental change. Young cretins who have not learned to speak a word soon begin to talk in their play. In children between six and ten the effects are even more remarkable, and with the loss of the myxœdematous condition there is a corresponding awakening of the mental faculties. In older patients the treatment is not so efficacious. (Osler.)

A grain of the desiccated gland three times a day in young cretins is the dose preferred by Osler, but, as already stated, its effects should be carefully watched and the amount reduced if the pulse becomes more rapid or if there is fever. Older patients may take as much as 5 grains in the day, and the amount may be diminished as the symptoms indicate Young patients bear the remedy very well, and in a few months, if no improvement is noted, larger doses must be tried, without, however, relinquishing watchful care.

Case of cretinism in a girl, 14 years of age, in which the thyroid-gland treatment was instituted and followed by a very slow improvement mentally and a much more marked one physically.

After undergoing the treatment at irregular periods during about nineteen months, her temperature suddenly rose to 104° F., her pulse to 160, and respiration became so short and thick that it was only with difficulty they could be counted. At this time she was taking 6 grains of thyroid extract daily. Medication was immediately stopped, but her condition remained the same, with one remission of temperature and pulse-rate, during two days, when, on January 22d, at one o'clock in the afternoon, she died. S. H. Friend (Med. News, Dec. 4, '97).

Case of cretinism; after the age of 30 years the patient's height increased nearly three inches through the administration of thyroid (3 grains three times a day) only; menstruation, which had not appeared until the age of 26, then occurred scantily at intervals of three or four months, became regular and normal; four additional teeth were cut, and her intelligence was much improved. Wharton Sinkler (Phila. Med. Jour.; Alienist and Neurol., Oct., '99).

Unpleasant effects are less commonly seen than in the myxœdema of adults. After the disappearance of the myxœdema and the establishment of the processes of growth and development, a very moderate dose seems sufficient: 1 or 2 5-grain tablets a week. Osler has noticed that an intermission for a month or six weeks does not seem to be followed by any striking change, but an intermission for a longer period is followed by symptoms indicating a relapse. This is clearly shown in the cases quoted above.

Thyroidin has proven of value and might be used instead if, for any reason, the more reliable preparations cannot be employed.

Case of cretinism successfully treated with thyroidin, in a girl of 11 years, who first manifested symptoms of her condition at the age of three years. Her mental condition was of a very low type. Two and one-half grains of thyroidin were given every other day, increased to 5, and still later to 7 ½ grains every day. The improvement was rapid from the beginning of the treatment, growth and mental development keeping up with the general progress. C. M. Anderson (Lancet, Oct. 2, '97).

Prevention of Cretinism. — The cases observed by Gordon Paterson would tend to demonstrate that the administration of thyroid extract during pregnancy to a woman who had previously given birth to cretins would so modify her physiological functions as to render her capable of bringing forth normal children.

Treatment of a mother in her third pregnancy, from the beginning of the third month, who had given birth to two cretins in successive pregnancies. One tabloid taken every day during the remaining seven months of the pregnancy. At no time did she suffer from any discomfort; on the contrary, was much better throughout than she had been in the previous pregnancies. The child was a fine, healthy female, indistinguishable from any other infant in appearance. At the age of 5 months, the infant is remarkably fine and intelligent and can sit up finely. She is now able to stand and to say several words and is 11 months old. A. Gordon Paterson (Lancet, Oct. 2, '97).

Cutaneous Diseases.—The hopes at first entertained have been, to a great degree, dispelled by the results obtained. In psoriasis thyroid extract has not shown itself as effective as other forms of treatment. In lupus and leprosy indications would seem to warrant further trial. The same might be said of keloid.

According to Don, who used thyroid gland with advantage in cases of ichthyosis, there is no doubt that it is strongly stimulating by directly increasing the cutaneous circulation, as evidenced in sensations of flushing, hot tingling, and congestive irritation, frequently felt as a precursor to ordinary perspiration. The increased cutaneous vascular supply apparently results in: 1. Increased nutri-

tion of the skin; hence its probable remedial action in ichthyotic conditions: an effect produced without any necessary abnormal perspiration. 2. Increased action of the cutaneous glands, accelerating excretion of waste-products, thus keeping the surface in a supple condition. 3. Regrowth of hair, as shown in myxœdema and some cases of general alopecia. 4. Increased activity of the epidermal layers, causing desquamation of unhealthy epidermis and reproduction of a new covering, as observed in ichthyosis, psoriasis, dry chronic eczema, and also in some cases of myxœdema and cretinism.

In other diseases, however, in which the remedy was employed the results have been such as not to warrant further trial. Indeed, the untoward effects sometimes attending its administration and the uncertainty of the results have caused many dermatologists to abandon its use altogether.

The use of thyroid extract is only permissible when the patient can be kept constantly under observation, because of the severe and sometimes dangerous symptoms which it produces. Zarubin (Archiv f. Dermat. u. Syph., B. 37, H. 3, '96).

The thyroid extract has certainly no specific action in scleroderma, as it has in myxœdema. In no case did the skin of the affected regions become softer or regain its natural appearance. In two cases the disease did not progress under its use. Two of the cases—one with tachycardia—took it for eighteen months, and another for nineteen months, without any ill effects; the latter case gained weight. W. Osler (Jour. of Cut. and Genito-Urin. Dis., Mar., '98).

Curative effects observed in urticaria. The extract was being used for obesity with chronic and persistent constipation. The patient for several years had been a victim of urticaria. She had been treated at various times with no results. Two hundred 5-grain tablets of the extract were taken at the rate of three per day. From the third day (eight months ago) she has not been troubled either with the constipation or the urticaria, though the obesity was not influenced. J. N. Roussel (New Orleans Med. and Surg. Jour., April, 1902).

Psoriasis.—Of all the skin affections psoriasis is the only one in which thyroid extract seems to have proved beneficial in a reasonable proportion of the cases in which it was used. But at best its effects are not to be relied upon, and it should only be tried after arsenic and other standard measures have been fully tried.

Four cases of psoriasis treated by thyroid extract, in the form of pastilles. Two daily, equivalent to one thyroid gland, were given. One of the patients took thyroid gland daily. In none of the cases did any improvement result from the use of the medicament. The ingestion of a thyroid gland in one case produced a febrile condition, nausea, and diarrhœa, without any manifestations of acute dermatitis. Menau (l'Encéphale, June 10, '94).

Results in twenty cases of psoriasis: In a very considerable proportion of cases the thyroid treatment produces a temporary cure, the eruption entirely disappearing and the skin being left in an absolutely healthy condition. In exceptional cases small doses produce a rapid improvement, while in others improvement is only produced after distinct symptoms of thyroidism. Some obstinate cases ultimately yield to very large doses, continued for a long time.

No case should be regarded as hopeless unless thyroidism has been produced, the largest dose which the patient can take having been continued for at least two months. In several cases the first effect of the remedy is to produce an extension of the eruption, this being most marked in cases in which the treatment is most successful. In some cases the treatment produces no effect. Relapses are not prevented. Long-standing, chronic cases are more readily cured than the more recent ones. Treatment begun with small

doses and increased until distinct symptoms of thyroidism are produced. Byrom Bramwell (Jour. of Dermatology, July, '94).

Disappointed with the effect of thyroid in psoriasis. Although some of the cases treated had been benefited in a marked manner, the majority had not. Even in the cases that had been improved equally good results, with much less disturbance of the patient's health, would have been achieved by the vigorous use of external remedies, such as ointments and baths. P. S. Abraham (Med. Press and Circular, Jan. 2, '95).

Thyroid treatment has a limited sphere of usefulness; unsuited for elderly patients with weak hearts. Radcliffe-Crocker (Lancet, June 8, '95).

Cases successfully treated by thyroid extract. Wilson (Brit. Med. Jour., Feb. 16, '95); Preece (Brit. Med. Jour., Mar. 30, '95); see Annual, '96.

Case of psoriasis with insanity. The patient was depressed, suspicious, and his memory was impaired. He was put to bed and thyroid tablets, in 15-grain doses three times a day, were administered. On the third day a marked change in the mental condition was observed. He woke up from his confused lethargy, appeared quite collected, read a newspaper, and took an interest in his surroundings. His improvement was steady. The thyroid was reduced to 5 grains a day on the eighth day, and this amount was given daily for another week. The psoriasis had entirely disappeared by the end of the fourth week, leaving very little scarring. He had lost sixteen pounds in weight during the treatment, but he soon regained his lost flesh. He was discharged cured two months after admission, and eighteen months later had had no return of the skin or mental affection. H. de Maine Alexander (Lancet, Dec. 8, 1900).

Very severe case of long-standing psoriasis covering nearly the whole body, the skin of which frequently cracked and bled and caused great pain and suffering. It was so extensive that it nearly resembled a fish skin and might have been almost classed as an ichthyosis. The patient was placed on large doses of thyroid extract and the rash cleared away very rapidly. During the treatment the digestive processes were on two or three occasions disturbed, associated with a rise of temperature, but soon righted again by a day or two's intermission of the treatment. The man was over 70 years of age. George Longbotham (Brit. Med. Jour., April 11, 1903).

Lupus.—In lupus vulgaris thyroid has not been extensively tried, but the benefit derived in a number of cases, and the unfavorable results attending other forms of treatment, warrant further investigations. Large doses are required.

Two cases in which thyroid extract was used: In the first, a girl aged 16 1/2 years, whose disease had persisted for nine years, covering the nose, left cheek, and upper lip, and extending from each corner of the mouth to the chin, administration of the extract was continued, with a few intervals, during six months. At the latter date the improvement was marked. In an intermission the disease retrograded, but improved again on the resumption of the thyroid treatment. After a year the patient was much improved, not cured. The second was a girl, aged 18 years, whose nose, mouth, and right eyelid were affected. Noticeable improvement was made within a month. Byrom Bramwell (Brit. Med. Jour., Apr. 14, '94).

Case of lupus vulgaris treated with thyroid extract and linear scarification. Face wonderfully improved. On passing the finger over the lupus it is found to be perfectly smooth and the ulceration apparently healed. G. G. Stopford Taylor (Med. Press and Circular, Oct. 3, '94).

Cases in which treatment by thyroid extract proved beneficial, but not curative. Abraham (Brit. Jour. of Derm., Aug., '94); Lake (Jour. of Laryn., Feb., '95).

Four cases where the results had been extremely good. P. S. Abraham (Med. Press and Circular, Jan. 2, '95).

Thyroidin appears to cause local reaction somewhat resembling that caused by tuberculin. Zum Busch (Derm. Zeit., Sept., '95).

Duration of treatment necessary to insure permanent cure, even with full doses given regularly and continuously, not shorter than one year. The dose in lupus, as in psoriasis, requires to be larger than what is found sufficient for myxœdema. The older the patient, the more cautious ought we to be with the quantity prescribed. J. Barclay (Brit. Med. Jour., Oct. 24, '96).

Two cases of lupus in which the results were very successful. In both cases there was no bad symptom. The points to be noted are preliminary scraping, the gradual increase in the amount of the drug, and the large quantity taken, as much as 90 grains a day in one case. Seen eight months later: in one case there was a tiny focus in the interior of the nose, and in the other there was no return whatsoever. F. G. Proudfoot (Brit. Med. Jour., Jan. 2, '97).

Leprosy. — Closely associated with lupus is leprosy, in a few cases of which thyroid gland has been tried. The results, though promising, do not warrant even an estimate of its value, and it is hoped that its merits will be further investigated.

Tried tabloids on the Trinidad Leper Asylum patients. Results not encouraging. The most powerful preparation of the drug had been pushed as far as safety would allow in leprosy. Bevan Rake (Med. Press and Circular, Jan. 2, '95).

Two cases of leprosy treated by thyroid gland; beneficial influence on both. Patients seen two years later and found apparently well and able to earn their living. The disease had not advanced. C. B. Maitland (Lancet, Oct. 31, '96).

Epilepsy.—The four cases given below would tend to show that thyroid gland is of no value in this disorder.

Cases selected for trial those in which many congenital defects were noticeable, and in which epilepsy had been a prominent feature of the patient's life since early infancy. The administration of thyroid not attended with very good results. While all seemed to be benefited for the time being, permanent improvement doubtful. Trial subjects lost from three to ten pounds in weight. The results would not seem to justify its continued use in epilepsy, and its further administration was not attempted. L. P. Clark (Med. Record, Oct. 24, '96).

Paralysis Agitans.—In two cases of paralysis agitans in which the thyroid was carefully examined by J. C. Castalvi, it was found markedly altered. In one there were extensive sclerotic changes, and in the other there was collocystic degeneration. The administration of thyroiodin or desiccated thyroid was found to give a marked improvement in paralysis agitans. The sweating was less noticeable, there was an improvement in the gait and increase in arterial tension, and a diminution of tremor.

Exophthalmic Goitre.—In the treatment of this condition the various preparations of thyroid have been found more harmful than beneficial in many cases.

This would seem to sustain the opinion expressed by M. Allen Starr, that if exophthalmic goitre is due to hyperactivity of the thyroid gland—a theory first proposed in 1886, and which has gradually gained ground since then—there is every reason why the thyroid treatment should be avoided. The few cases of reported improvement from this treatment would not, in his opinion, bear critical investigation.

It is probable, however, that in certain cases thyroid gland may prove of value, as shown in some of the instances reported below, and that we are as yet insufficiently informed to determine just where the remedy is applicable. It should certainly not be employed indiscriminately, and judging from a review of recent reports as a whole the condition of the heart would seem to influence the action of the remedy.

Case by thyroid extract, with improvement at first, followed later by deterioration. The thyroid extract was reduced, then stopped, but the patient died three weeks later. There was great proliferation of the thyroid epithelium. H. Power (N. Y. Med. Record, Aug. 11, '94).

Nine cases, all markedly improved. In the majority the improvement was slow, though steady, but in only one did the exophthalmos disappear. Bogroff (Gaz. Heb. de la Russie Mérid., Jan., Feb., '95).

In Graves's disease thyroid treatment contra-indicated. It is possible, however, that when the goitre seems to be the primary trouble some benefit may be derived from this agent. Senator and Mendel (Berliner klin. Woch., Feb. 3, '95).

Thyroid has no favorable influence, and is, indeed, likely to increase the discomfort, or, where the symptoms had abated, to light them up again. Stabel (Berliner klin. Woch., Feb. 3, '95).

Successful case after the use of a quarter of a lobe eaten raw twice a day. Fergusson (Brit. Med. Jour., Oct. 20, '95).

Case in which 1 1/2 to 2 drachms of sheep's thyroid daily before meals, small amounts of gland daily, then omitting use for ten days every three weeks, caused all symptoms to disappear except slight swelling and slight exophthalmos. Voisin (La Sem. Méd., Oct. 24, '95).

Cases in which the remedy aggravated the active symptoms. Dreyfus-Brisac and Béclère (La Sem. Méd., Oct. 24, '95).

Three cases in which good results were obtained. Voisin (Revue de Thérap., p. 728, '95).

Patients who have been treated with thyroid extract prior to operation seem to be more liable to heart-failure both during and after this proceeding, and one or two deaths have been attributed to this cause. Angerer (Münchener med. Woch., 21, '96).

Case of woman, 40 years old, who had been treated unsuccessfully with arsenic. The action of the heart was tumultuous and the pulse-rate was 160. The tremor in the hands was so pronounced as to prevent the patient's continuance of work as a sewing-machine operator. The woman received from a friend 120 tablets of thyroid extract, each of 10 grains, and took six of these daily. After the lapse of three months the patient appeared almost entirely well. Slight struma was still discernible, but exophthalmos and Graefe's sign had disappeared; the pulse ranged from 90 to 96; the tremor in the hands was absent; and the roaring over the heart was no longer apparent. The patient herself felt perfectly well. Silex (Berliner klin. Woch., No. 6, '96).

Case apparently much benefited by the administration of thyroid extract. The case had existed for a number of years, and thyroid enlargement has been quite distinct. After the thyroid extract had been given for about a week, the pulse had dropped from 110 to 80, and ever since then the patient has been much more comfortable. It was necessary, however, to take thyroid every few months. There had been no return of the enlargement except for a few days, while the patient had had a cold. Hallock (Jour. Nerv. and Mental Dis., June, '96).

In fifty-one cases of exophthalmic goitre, treated by the thyroid extract, the size of the gland has been diminished, but the other symptoms have not been relieved. Crary (Jour. Nerv. and Mental Dis., June, '96).

Case made very much worse by the thyroid extract. Leszynsky (Jour. Nerv. and Mental Dis., June, '96).

Four cases showing that, while thyroid extract has certainly accomplished a cure in two of the cases, the indications are strongly against its indiscriminate use in exophthalmic goitre. It acted beneficially in the two cases and injuriously in the two others. Its cautious exhibition, in proper cases, however, is not to be discouraged. Henry L. Winter (Amer. Medico-Surg. Bull., July 11, '96).

A case of exophthalmic goitre successfully treated by thyroidin. Owing to anorexia and nausea, was obliged to suspend the treatment three times, and to reduce the dose, but after about sixty days all signs of the disease had disappeared. A year later the patient was

well, cheerful, and bright, and her menstrual functions are regular. R. M. Whitefoot (Med. News, Oct. 3, '96).

Case of a girl of 13 years whose father had been an epileptic and whose sister had died of tubercular meningitis. Marked exophthalmos; pulse, 140; thyroid gland perceptibly enlarged. Usual means having failed, resort had to desiccated thyroid, 5 grains after meals. After two days considerable relief. On the ninth day the powders gave out and in two days the pain returned. After five months of treatment, exophthalmos and thyroid enlargement greatly reduced, and patient comparatively well. Kerley (Pediatrics, June 1, '97).

Thyroid extract given in case of exophthalmic goitre in which sudden swelling of the gland was so severe as to interfere with breathing; also in a case of acute thyroiditis. In both cases the swelling subsided and symptoms were relieved. J. Eliot (Va. Medical Semi-monthly, June 28, '98).

GOITRE.—In simple goitre the preparations of thyroid prove effective in about two-thirds of the cases, the results ranging from total disappearance of the goitre to a noticeable reduction in its size. Children and young adults are benefited in the great majority of instances. A favorable result is seldom obtained in adults. Increasing doses seem to procure the most satisfactory effects. The influence of the remedy is felt after the first three or four days in successful cases, and, in a month or so, the reduction of an average tumor will generally have been effected. In order to keep the goitre from returning, the administration of the remedy must be continued, the preparation being given in reduced quantities and at longer intervals.

The results have been practically the same whether fresh or desiccated glands or extract were employed. Its administration should be carefully watched, however, and the dose reduced upon the appearance of any untoward symptom.

Six insane patients with goitre treated surreptitiously, using raw thyroid from the sheep, 1 ½ or 1 ¾ drachms concealed in slices of sausage in a sandwich, repeated in ten or fifteen days. In five cases there was an appreciable diminution in the size of the goitre after each ingestion of thyroid. No untoward symptoms. Emminghaus and Reinhold (Les Nouveaux Remèdes, No. 18, '94).

Nineteen patients treated with tablets, but in no case did the goitre disappear entirely. The gland sometimes became smaller, but not unless the patient was young, and the effect was only temporary. Ewald (Berliner klin. Woch., Feb. 3, '95).

Ninety-three patients treated partly with an extract of fresh thyroid glands of wethers and partly with thyroid tablets. In twenty-five cases glands of freshly slaughtered animals reduced to a pulp and mixed with water were used exclusively, the average quantity taken by a patient in a week being 5 drachms, although in some cases it rose to 9 drachms. In the hot season the patient complained of slight gastric troubles, which, however, disappeared as soon as the thyroid preparation was preserved in ice. There was only one instance in which the treatment had to be discontinued on account of its disagreeing with the patient. The thyroid gland regained its normal dimensions in only four of the twenty-five patients treated in this way, and in only two of these four was the good effect permanent, for the other two had a relapse after the expiration of a month. In all the other cases there was an obvious reduction in the size of the gland, and with two of the patients this was permanent, but it generally began to swell again whenever the treatment was stopped. The frequency of the pulse was a little augmented, but never so much as to make an interruption of the treatment necessary. A number of patients after having taken the fresh glands for several weeks were then treated by tablets. In another series these tablets were used from the beginning of the treatment. The results were much less satisfactory. Stabel (Berliner klin. Woch., Feb. 3, '95).

Sixty cases of benign parenchymatous goitre, without selection, treated with thyroid tabloids, 2 daily to adults, 1 to children. Duration of treatment from three to four weeks, on the average. In young children complete recovery the rule. In adults recovery rare and less common in proportion to age. Complete return of thyroid to normal size not to be expected later than twentieth year. Bruns (Amer. Jour. Med. Sciences, May, '95).

Warning against too sanguine views as to success of thyroid treatment. Kocher (London Lancet, July 20, '95).

Cases treated by desiccated thyroids. Size rapidly reduced, though treatment not maintained for a sufficient time to establish final recovery. Remedy not free from danger if given in unlimited quantities and over too great a length of time. Illustrative case. E. Fletcher Ingals (Medicine, Aug., '95).

Among twenty-one cases of goitre, in eleven, of from 2 to 17 years of age, there was considerable diminution, but not complete disappearance, of the tumor; in five, from 12 to 21 years of age, the amelioration was slight, and in five cases there was no result. Knöpfelmacher (Wiener klin. Woch., Oct. 10, '95).

[In a case of goitre under my care, in which thyroid tablets were given, the latter had to be discontinued on account of untoward symptoms: accelerated and weak pulse with tendency to syncope, accelerated respiration with dyspnœa, increased diuresis, and, also, pronounced anorexia, which disappeared upon the withdrawal of the thyroid extract. C. Sumner Witherstine, Assoc. Ed., Annual, '96.]

Nine children suffering from parenchymatous goitre healed with Merck's tabloids containing 5 grains of thyroidin.

Children under two had from $^1/_2$ to 1 tabloid daily during the first week, and from 1 to 2 tabloids daily afterward; older children, after the first week, as many as 4 or 5 tabloids allowed daily. Marked diminution in the size of the gland, the improvement commencing after about three days' treatment and reaching its maximum in three weeks.

In all the cases treated the rapidity of the heart's action was increased; but, on the discontinuance of treatment, the action again became normal. Cautious use of the drug advised, beginning with small doses, and gradually increasing them. If the heart's action becomes irregular, suspension of treatment. Dobrowsky (Arch. f. Kinderh., B. 26, '96).

Seventy-eight cases treated with thyroid. In all the cases in which the treatment was tolerated and continued for several weeks, diminution of the goitre was attained. Best results noticed in the soft, simple, hyperplastic goitres, especially in those occurring about the age of puberty. Cystic goitres became more superficial through the atrophy of the hyperplastic tissues, and their enucleation was facilitated. Angerer (Münchener med. Woch., p. 93, '96).

Thyroid gland is best adapted for the form known as struma parenchymatosa. Definite cure is rarely observed and only in young subjects. The results are satisfactory in 63 per cent. of cases, the goitre lessening in size. In 30 per cent. of the cases the treatment is absolutely valueless. When goitre has undergone secondary degenerations, such as colloid or cyst- formation, the treatment is useless. Sérafine (Revue de Thér., July 15, '97).

Case of weak, cachectic newborn infant presenting a marked bilobed goitre. The mother, herself goitrous, was in excellent health, but mentally weak. The treatment of the mother consisted in daily administration of 22 $^1/_2$ grains of thyroid body. At the end of one month and a half her goitre had almost totally disappeared, and in the infant the cure was complete. Mossé (Revue Men. des Mal. de l'Enfance, June, '98).

Thyroidism in an infant from administration of thyroid extract to the mother, a woman, aged 34, who had exophthalmic goitre. On December 24th thyroid extract (two 5-grain tabloids daily) was administered to the mother. On January 1st the child had been sweating profusely for several nights. It was looking ill and was sleepless. It had vomited every morning for three days. The extract was consequently stopped for five days. The child immediately improved, and on January 4th was quite well. On the

ninth thyroid extract was again given to the mother. The next day the child vomited, was again restless, did not look well, and sweated profusely, etc. The child was weaned and after this remained perfectly well. Byrom Bramwell (Lancet, Mar. 18, '99).

INSANITY.—It is in melancholia and the mental disorders connected with the menopause that thyroid extract finds its greatest usefulness. In recurrent mania, delusional insanity, excellent results have also been reported. MacPhail and Bruce consider its use dangerous in cases of acute mania and melancholia where there are rapid loss of body-weight and malassimilation of food; also in cases where there is active phthisis or valvular disease of the heart. The profound effects of the drug on the circulatory system render it imperative that during treatment, and for at least a week afterward, the patient should be rigorously confined to bed.

Osler is of the opinion that the cases of insanity in which thyroid extract proved beneficial were probably cases in which there was some derangement of the thyroid gland. The pulse ran up under its influence in some cases to 160, but in none had it caused any serious results.

Kinnicutt, in sustaining this view, thinks that the very fact that in a large majority of the cases the treatment is without effect, while now and then it is so strikingly successful, would indicate that in the latter the trouble was probably connected with diminished or perverted secretion or function of the thyroid gland. As in other disorders, the use of thyroid has to be continued after recovery to prevent relapse.

In twenty-five cases internal administration of thyroid induced true febrile process; resulting action beneficial. Specially useful in insanity of adolescent, climacteric, and puerperal periods, and frequently so in cases where recovery is protracted and tendency is to drift into dementia. Bruce (Jour. of Mental Science, Jan., '95).

Four cases of insanity with well-marked stupor where the outlook had become unfavorable, if not hopeless. A decided reaction sought for, and the dose of thyroid regulated by the tolerance of each patient. No benefit in one case; two sufficiently benefited to be discharged from the asylum, and a fourth materially improved. Cell-nutrition is undoubtedly affected in a striking manner, and increased metabolism occurs as the result of quickened circulation. The autotoxic process, so frequently present in cases of mental disease, is interfered with in a way that may be beneficial. C. K. Clark (Canadian Pract., Oct., '95).

Cases of post-melancholic hebetude following a lengthy period of depression offer the best prospect of improvement and are more or less influenced in the majority of instances.

Cases of stuporous melancholia of long duration are usually improved by thyroid. Cases which recover appear to have a special predilection to relapse.

Maniacal cases whose attacks have been unduly prolonged give a very encouraging prognosis.

Cases of cerebral exhaustion following acute delirium or stupor whose elimination of urea and other nitrogenous compounds is greatly reduced, offer a fair chance of improvement.

Many cases of chronic mania without fixed delusions may be benefited by a course of thyroid treatment.

In doubtful cases thyroid may assist in clearing up the diagnosis. It will early differentiate between true stupor and dementia. In delusional cases of a doubtful nature a course of treatment will usually show whether delusions are fixed or temporary, as the latter will vary in character or entirely disappear during treatment, while the former undergo no change whatever. W. L. Babcock (State Hosp. Bull., Utica, N. Y., Jan., '96).

The early use of the thyroid and treatment of forms of insanity not associated with myxœdema appears to have been

based upon observations made in the use of thyroid in other conditions, showing that a mild febrile reaction follows the employment of the gland. It was to induce this febrile reaction that first suggested the employment of the thyroid in non-myxœdematous cases of insanity.

Case characterized by delusions of doubt and fear, especially of fear of contamination, improved. Better control over most of the ideas of contamination.

Case of chronic delusional insanity, violent, untidy, destructive, with rough skin and scanty hair, rapidly improved.

Case of a mild case of simple melancholia with slight enlargement of the thyroid gland; at first more depressed, but now convalescent.

Case with attacks of recurrent maniacal excitement. At first evident elevation of temperature, flushed face, free perspiration, and slight nausea. Patient practically convalescent.

Two cases of chronic melancholia in men in which no improvement was manifest.

Inclined to indorse the views of Bruce, that the thyroid undoubtedly produced a more or less feverish condition, the action and reaction to which are of considerable benefit to the patient. Thyroid is a direct cerebral stimulant, and there is a strong probability that at some periods of life the administration of thyroid supplies some substances necessary to the bodily economy. E. N. Brush Jour. of Nerv. and Mental Dis., Apr., '96).

One very important function of the thyroid is to stimulate brain-metabolism. We must regard the thyroid extract as containing a most potent cerebral stimulant which does alter, in some way, the metabolism of the nerve-centres and stimulates them in a most extraordinary manner. William Osler (Jour. of Nerv. and Mental Dis., Apr., '96).

Forty cases, consisting chiefly of commencing senile dementia, acute mania, and melancholia, treated with thyroid. Of these, eight were unaffected by the treatment, twelve were somewhat and fourteen were much improved, five cured, and one died. The drug had an altogether extraordinary influence on the mental condition of the patients. Among clinical symptoms during the use of the remedy, rise of temperature and pulse-rate, gastric disturbances, increased perspiration and quantity of urine, transient albuminuria in 10 per cent., œdema of face and extremities, cyanosis, desquamation of the skin, sexual excitement,—so that masturbation in three cases necessitated the discontinuance of the thyroid extract,—were observed. C. G. Hill (Trans. Med. and Chir. Fac., Maryland, p. 30, '96).

Thyroid treatment of great value in a form of mental disturbance occurring at the climacteric: a mental depression with anxiety and morbid fears, but without delusions of insomnia. Allen Starr (Amer. Jour. Med. Sci., vol. cxiv, No. 1, '97).

Insane cases in which a pill containing 5 grains of fresh sheep's gland was administered daily, and subsequently increased to two or three according to results. Besides the usual symptoms there was more or less mental or motor excitement in all cases no matter how depressed or demented the patients had been previous to the administration. In some instances there was considerable mental improvement. Berkley (Johns Hopkins Hos. Bull., July, '97).

In conditions marked by inhibition of sensory, motor, and mental activity, without gross organic lesion, such as obtain in catatonia and in certain types of stuporous insanity and melancholia, we may expect benefit from thyroid medication, judiciously used.

Results of thyroid feeding in twenty patients. The extract, in tabloids of 5 grains each, administered. 1. Melancholia agitata. Four females and one male. The four females were unimproved, the male greatly benefited. 2. Melancholia. Three females and four males. The females and all but one of the males were unimproved. 3. Senile dementia. One female. No improvement under treatment. 4. Chronic mania. Two females. No improvement under treatment. 5. Mental enfeeblement. One female and two males. No improvement

under treatment. 6. Dementia. One female and one male. No improvement under treatment. In all cases the pulse was the first to show any change, and was most affected by the drug. Robert Cross (Edinburgh Med. Jour., Nov., '97).

Results of administration of thyroid extract on the red and white corpuscles and hæmoglobin in cases of anæmia associated with melancholia. In 9 cases thyroid medication was employed and in 5 cases there was a marked change for the better; in the other no favorable influence was noted. In 3 of the 5 in which improvement took place there was increase of weight during the treatment, and in 2 subsequently. The psychological effect was observed almost from the beginning in those in which permanent improvement took place. Samuel Bell (Phila. Med. Jour.; Brit. Med. Jour., July 9, '98).

As a result of thyroid treatment in 1032 collected cases of insanity, the following conclusions reached: 1. The dose of the extract depends entirely on the individual case. In some cases 25 grains three times a day will be necessary to bring about a circulatory or temperature reaction, while in others the same results may be had with the use of 5 grains *t. i. d.* Each case must be a law unto itself. 2. It is essential that the patient should be placed in bed to obtain the best results, and he should be continued there during the entire treatment and for a week following its discontinuance. 3. The treatment should be continued for at least thirty days. 4. We should not be discouraged by failure in the first administration, but should resort to two, three, or more trials, if necessary. 5. The most gratifying results in thyroid treatment are to be obtained in cases of acute mania and melancholia with prolonged attacks, puerperal and climacteric insanities, stuporous states and primary dementia, particularly where these forms of mental alienation do not respond to the usual methods of treatment. 6. A high temperature reaction is not essential, as the average maximum temperature in the recovered cases among men was 99.6°. 7. Physical improvement is the outcome in most cases whether mental improvement takes place or not. 8. The proportion of individuals who recover under thyroid treatment and then relapse is less than the proportion that relapse after recovery from other methods of treatment. In personal series of cases only one patient who recovered has relapsed. William Mabon and Warren L. Babcock (Amer. Jour. of Insanity, Oct., '99).

Trial of thyroid in 130 patients whose insanity was definitely making no progress toward recovery under the methods adopted in the asylum, or whose insanity was becoming chronic or incurable. Each patient was put to bed during the period of experiment, and was given a staple diet sufficient to maintain body-weight at its usual level, the administration of the extract beginning on the fifth day. The patient was weighed weekly during treatment and for a month after. The urine was regularly examined and the urea was estimated by the hypobromite method. The phosphates in the urine were determined by the uranium method. The thyroid extract was administered in 130 cases of insanity (45 males and 85 females) with the following results: Where large doses were given there followed pyrexia in most of the cases to a slight or moderate degree. Loss of weight was a constant symptom, also increased sweating, pains, and tinglings in various parts of the body, and a slight or moderate degree of exaltation, or restlessness. There was tachycardia in most cases, and the respirations were increased by about six per minute. Appetite and thirst increased, and in females menstruation was made more profuse than usual. Urea and nitrogenous products were increased in the urine, showing an enhanced metabolic activity. Slight transitory albuminuria was found in 10 per cent. of the cases. In moderate and small doses the above results were present in a correspondingly less degree, and it was concluded that the thyroid extract acted as a powerful metabolic (katabolic) stimulant. The patients included five idiots and imbeciles, seven pubescent or adolescent cases, and cases of mania, melancholia, myxœdema, alcoholic and general paralytic insanity, etc.

Of a total of 130 patients, 12 recovered, 29 were improved, and 89 were unimproved. The recoveries included 4 cases of stupor, 3 of puerperal mania, 1 of lactational melancholia, 1 of myxœdema, 1 of simple melancholia, and 2 of climacteric melancholia. These patients also improved physically. The threatened attacks of *folie circulaire* were aborted by thyroid administration. C. C. Easterbrook (Lancet, Aug. 25, 1900).

MYXŒDEMA. — With very few exceptions, cases of myxœdema are always attended by well-marked atrophy of the thyroid gland. That the disease is a result of the absence from the blood of the secretion of the thyroid is a logical conclusion which the use of the gland as a remedy has amply verified. Again, the fact that absence of the gland is the primary factor in the etiology of the disease also makes it plain that unless the secretion which it furnishes the system is replaced continuously the disease will recur after recovery: another fact verified by practical experience, which has shown that small doses of the gland must be administered for years if the recurrence of the myxœdemic symptoms is to be prevented.

As originally recommended by Murray, the treatment should be divided into two stages: (1) removing the symptoms of the disease; (2) maintaining the condition of health attained. The first stage must be carried on gradually, and with care, as the alteration in the patient's condition is so great that, in many cases, it is not safe to bring it about rapidly. This caution applies especially to cases which show signs of cardiac or vascular degeneration. Several such patients have died of syncope brought on by overexertion, after the symptoms of myxœdema had been much improved. Ten to 15 minims of the extract, twice or thrice a week, may be slowly injected. If flushing of the face or pain in the lumbar region occur, the injection should be stopped. When taken by the mouth from the beginning, daily doses of 5 to 15 minims two or three hours after breakfast have been found best. The changes which take place in the temperature, pulse, weight, appearance, and sensations of the patient are all important in governing the dose. In the second stage, the smallest dose which keeps the temperature up to the normal, or above 97° F., is sufficient. The remedy is given preferably by the mouth in this stage.

When cardiac disorders are present, the dose should be small and the patient kept in the recumbent position, as advised by Bramwell.

Two deaths, under treatment, of patients with weak heart. F. Vermehren (Centralb. f. Nerv. Psy., etc., July, '93).

The dose should be much smaller when cardiac disorders are present than the usual one. Complete rest in the recumbent position should be enforced from the commencement of the treatment. B. Bramwell (Practitioner, July, '93).

Effect of thyroid extract in myxœdema complicated by angina pectoris beneficial. No discomfort until the twelfth day, when extract discontinued. H. C. L. Morris (Lancet, Sept. 28, '95).

Statistics of one hundred and sixteen cases, with absolute failure to secure improvement in only three, show the value of the thyroid treatment. Reports vary in regard to the degree of improvement from "cure" to "slight improvement." The latter cases, however, were few in number. (Eskridge.)

Case of myxœdema placed on a diet regulated so that its different elements should be, as far as possible, the same each day. At the end of a week treatment with thyroid extract was begun, the diet remaining the same. During treatment the urine was increased in volume; the nitrogen excreted in the urine exceeded the total quantity of

nitrogen in the food, and appeared in the urine chiefly in the form of urea. Phosphoric acid and chlorine elimination was practically unaffected. The body-weight was diminished rapidly and the temperature raised. Mental improvement in myxœdematous patients under the thyroid treatment has generally been as marked as the physical. W. M. Ord and E. White (Brit. Med. Jour., July 29, '93).

Eleven cases of myxœdema treated by thyroid grafting. Improvement in six and failure in five cases. Kinnicutt (Med. Record, Oct. 7, '93).

Case of a boy, about 5 years of age, who, in the early part of the treatment, took one-fourth of the thyroid gland of a sheep each twenty-four hours. Later on the gland was given him in a desiccated form. In fourteen months the boy grew four inches: an unusual increase. At the time of the report he walked and ran about, and had gained so much mentally that few would think him abnormal in this particular. Osler (Med. Record, July 21, '94).

Three cases of myxœdema in which fresh thyroid gland was given. Results excellent, but temporary. If moderate doses be given, the symptoms characteristic of goitre can be made to disappear gradually. W. Pasteur (Rev. Méd. de la Suisse Rom., p. 35, '94).

Unmistakable improvement in three cases of myxœdema. Good results from the use of the tabloids containing, each, 5 grains of the extract. Starr (Boston Med. and Surg. Jour., Sept. 27, '94).

Two cases of myxœdema in children, one a girl 9 years old, the other a boy 12 years old, treated with glycerin extract of sheep's thyroid. Improvement. Northrup (Archives of Pediatrics, Nov., '94).

In a case of congenital myxœdema treated with thyroid, diameter of red corpuscles before treatment began was 3.13 microns; after, it was 7.5 microns. Nucleated red corpuscles disappeared under treatment. Persistence of a fœtal state of blood seems to coincide with a tardy development of the body. Lebreton and Vaquez (La France Méd. et Paris Méd., Jan. 18, '95).

The treatment of acquired myxœdema in the adult is almost universally successful. When failure occurs, it is generally in experienced hands or the thyroid itself is not good. For a continuous good result treatment must be maintained, but, as the action of thyroid is cumulative, intervals of cessation, varying in different cases, are necessary. In winter larger doses and shorter intervals are necessary than in summer. Feeling of cold an indication to renew treatment. One grain of powder cautiously increased. Meltzer (Amer. Medico-Surg. Bull., July 1, '95).

Several children suffering from myxœdematous idiocy, in whom physical and intellectual conditions were greatly benefited by thyroid alimentation. Bourneville (Revue de Thér. Médico-Chir., Nov. 1, '95).

Sixteen cases of myxœdema treated with thyroid gland, in two of which exact estimates of metabolic processes made, metabolism of proteids found to be excessively small, proteids of food digested in a defective manner; when thyroid ingested, more nitrogen excreted and whole metabolism improved. Vermehren (Univ. Med. Jour., Nov., '95).

After-history of the first case of myxœdema treated by thyroid extract. The patient, a woman aged 46, who had suffered from myxœdema four or five years before the treatment was commenced in April, 1891, is still quite free from the disease. On two occasions, when the remedy was discontinued for some time, the symptoms partly returned. She still takes 1 drachm of thyroid extract each week. C. R. Murray (Brit. Med. Jour., Feb. 8, '96).

Series of cases, some of which had been under continual and regular treatment, others in which the treatment by thyroid extract had been irregular and intermittent. The cases in which the treatment had been continual had lost all the characteristic features of myxœdema, and could no longer be recognized as instances of that disease. Other cases in which the treatment had only been irregularly carried out still presented characteristic features of myxœdema. Myxœdemic patients taking thyroid

preparations complained of a great deal of pain in the back or limbs, and that it was worthy of consideration whether those pains might not be of a gouty nature. Thomas Harris (Brit. Med. Jour., Feb. 15, '96).

Priority claimed, as regards giving the thyroid gland by the mouth, for Dr. Howitz, of Copenhagen. Polyuria, rise of temperature, insomnia, and pains in the limbs are signs warning that the remedy should be suspended. Dupaquier (New Orleans Med. Jour., Mar., '96).

Case in which, after treatment by extract of thyroid for six weeks, all symptoms had disappeared and the reduction of the weight was forty pounds. This method of treatment does not influence favorably cases of ordinary obesity. All cases must be carefully studied and selected before this powerful agent is to be administered. J. M. Anders (Med. and Surg. Reporter, June 12, '97). (See MYXŒDEMA.)

Where the total removal of the thyroid has been practiced, Billroth observed no onset of tetany in 109 cases. Weiss found 23 per cent. among 53 cases, Roux none in 118. Eiselsberg, Schiff, Wagner, and Horsley saw symptoms of tetany and of chronic convulsions in animals deprived of a more or less large portion of the thyroid gland. Tetanus commences with trismus, and thereafter affects the more peripheral muscles, and is remittent, not intermittent; while tetany first affects the muscles of the extremities, never beginning in the masseters, and is always of an intermittent type. Schilling (Münchener med. Woch., Feb. 21, '99).

Case of myxœdema complicated by mental symptoms in which thyroid extract was used without effect for two months; after this marked and continued improvement occurred. R. R. Leeper (Brit. Med. Jour., Jan. 27, 1900).

LACTATION.—In the various disorders of lactation the thyroid preparations have been found of signal service, especially as galactagogues.

Because of its specific action upon the mammary glands, thyroidin is of great value to women in whom lactation is imperfect. Hertoghe (Rev. Méd-Chir. des Maladies des Femmes, June 25, '96).

Thyroid extract is a valuable galactagogue; it stimulates the mammary secretion, while it lessens functional activity of the uterus. Chéron (Revue Médico-Chir. des Mal. des Femmes, Nov. 25, Dec. 25, '96).

Two cases in which deficiency of milk was counteracted by tabloids of thyroid gland. In one of these the milk became free while tablets were being taken, and failed as soon as they were neglected. Stawell (Intercolonial Med. Jour. of Australasia, Apr. 20, '97).

Extract of thyroid gland found to be an efficient galactagogue in certain cases, and the milk secreted under this influence found to be of good nutritive quality. Stawell (Intercolonial Med. Jour. of Aus.; Ther. Gaz., Jan. 15, '98).

MIDDLE-EAR DISORDERS. — A few myxœdematous patients, suffering from deafness, having improved in hearing during the administration of thyroid extract, several observers gave this drug a trial in chronic adhesive processes of the middle ear uncomplicated with myxœdema. Various results have been obtained, success or non-success evidently depending in a marked way upon the degree of thickening and ankylosis that may be present. On the whole, thyroid is not of much value in aural diseases.

Results obtained in a number of patients in Politzer's clinic, commencing with 1 tabloid daily, and increasing them in a fortnight's time to 3 per diem. After four weeks of treatment the drug was discontinued for a week, and again resumed. No bad symptoms observed. At first marked impairment in hearing, both to loud speech and to whisper, while tuning-fork vibrations were better heard through the bone. Sixteen cases remained under treatment and observation from six to eight weeks. Eight remained subjectively and objectively unchanged. Of the remaining eight, two showed evident improvement; four gave a satisfactory result; while in two there was a marked and continued improve-

ment in hearing. Brühl (Monat. f. Ohren., Jan., '97).

Eight cases of sclerosis of the middle ear treated with thyroid tablets, about 5 grains given daily for periods varying from thirty to eighty days. In none of the cases were there any bad results, either in the ears or general system. A permanent improvement in hearing was obtained in three of the eight cases. A. Eitelberg (Archiv f. Ohren., vol. xliii, Part 1, '97).

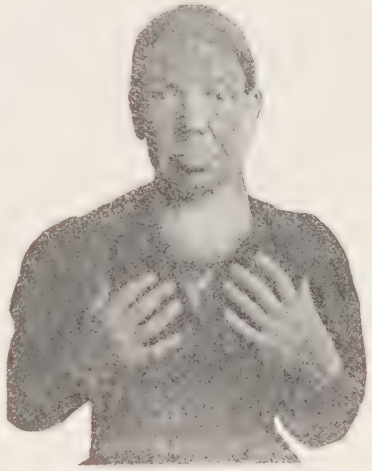
Trial of thyroidin in fourteen cases of deafness—due in eight cases to adhesive processes, in six to sclerosis. All the cases had previously undergone other treatment without success. Treatment terminated at the end of three weeks where no improvement had occurred. Nine cases showed no improvement. Two had some diminution of tinnitus. In two a marked gain in hearing was experienced. Morpurgo (Rev. Hebd. de Lar., Apr. 23, '98).

Results arrived at by careful treatment, after the manner of Brühl, of 21 cases of middle-ear disease with thyroid. Duration of disease varied from one to twenty years. There were 15 cases of sclerosis, 3 of middle-ear catarrh with ossicular ankylosis, and 3 of ossicular ankylosis following suppurative disease. Nearly all the cases had already been treated in other ways. In no single case did any benefit result from the thyroid, although several cases were benefited by being treated by other methods. Macleod Yearsley (Jour. of Laryng., Rhin., and Otol., Sept., '98).

MUSCULAR AND OSSEOUS DYSTROPHIES. — *Muscular Atrophy.* — The fact that two cases of muscular atrophy were greatly improved and reported as such by so reliable an observer as Lépine would indicate that a portion, at least, of these cases can be benefited.

Thyroid gland employed in two cases of muscular atrophy and successful results obtained. In one case—a man, 44 years of age, who had suffered for eight years—2 ounces daily had been administered for about two months. Improvement had taken place in about two weeks after the beginning of the treatment. The patient felt stronger and had been able to walk alone, which he had not been able to do for some time. Lépine (Revue Inter. de Méd. et de Chir., Aug. 10, '96).

Acromegaly.—The reports of cases of this disease treated with thyroid have been insufficient to warrant a conclusion, but it would seem probable that conditions due to disorders associated with myxœdema or goitre could alone be expected, the osseous hypertrophy being beyond the remedial process.



Case illustrating the association of acromegaly and goitre. (*G. R. Murray.*)

Case of acromegaly treated with dried thyroid extract in gradually increasing doses until 12 grains a day were taken, besides galvanism and tonics. Three months later she was feeling very much better, her memory had improved, and she spoke and moved more rapidly. She had lost over twenty pounds in weight, but felt stronger. General condition practically the same. The history of the case and the marked physical changes leave little doubt that it was a case of acromegaly, but certain anomalous symptoms—such as the puffy conditions of the eyelids, which may, however, have been simply the result of anæmia, though its appearance was somewhat different; the

slow speech, and the altered mental state —suggested that her condition was also associated with a loss of function of the thyroid gland. G. G. Sears (Boston Med. and Surg. Jour., July 2, '96).

Case of a woman, 26 years old, who had suffered from acromegaly for upward of two years, and who for a period of five months had been treated with mixed pituitary and thyroid extracts, with great improvement. The superficial resemblance between acromegaly and myxœdema seemed to justify the administration of thyroid extract, especially as, in several cases of acromegaly, treatment with pituitary extract alone had failed to effect any improvement. Rolleston (Brit. Med. Jour., Apr. 17, '97).

OBESITY. — The selective action on adipose tissues shown to attend the increased metabolism brought about by thyroid, and the decided increase in the nitrogen excretion sustain the use of this agent in obesity. The effects have been irregular, however, some patients responding readily to the influence of the remedy, but others not doing so. The views of the French authors in this particular perhaps afford an explanation, namely: young, vigorous, and plethoric individuals, who are good livers, receive little or no benefit from thyroid treatment, but are benefited by a dietetic regimen. On the other hand, fat persons that are pale, soft, and flabby, and inclined to œdema, receive benefit from the ingestion of the thyroid gland. They lose weight rapidly, oxidation is increased, and nutrition is improved. We are again brought face to face with conditions showing some of the elements of myxœdema.

Besides the dangers attending the use of thyroid in any case, the only source of untoward effects is the giving of large doses at first, the organs, especially the heart, being thus exposed to the effects of undue reaction. In appropriate cases the remedy is taken without trouble, and the effects soon show themselves. After a time the reduction in weight is proportionately smaller, and discontinuance of the treatment is followed by recurrence, in the great majority of cases, until the former weight is reached. To maintain the advantage gained, however, dieting and small doses of thyroid at longer intervals may be utilized with advantage.

Case of obesity treated by thyroid juice, 15 1/2 minims dai'y, either by subcutaneous injection or by the mouth. In three months weight fell from 292 to 253 pounds. As soon as the treatment was discontinued the loss of flesh also ceased, and when the thyroid extract was resumed a daily loss of 1 2/8 to 4 1/8 ounces was observed, this becoming less after a time. A second case treated showed similar, but less marked, results, while in a third no effect could be noted. The inconstancy of results perhaps depended upon the different forms of obesity, upon the insufficiency of the treatment, or upon the extract used, which may not have been genuine. Charrin (La Sem. Méd., Jan. 2, '95).

The thyroid gland of the sheep a specific in obesity; free from danger and injurious after-effects, and the beneficial results of which appear within a few months from beginning of treatment. The sole risk is in beginning with large doses, as palpitations and fainting fits are possible until the patient is well accustomed to the drug. Frederick Guttmann (Amer. Medico-Surg. Bull., May 15, '95).

Case of a man who took a large quantity of tablets in the hope of reducing his obesity and became maniacal within a few days; œdema of the brain was found at the necropsy. Stabel (Lancet, Mar. 28, '96).

In excessive obesity with tendency to weakness and anæmia, in which exercise and diet fail, thyroid extract should be tried. H. C. Wood (Univ. Med. Mag., Apr., '96).

Of considerable value to reduce weight in obesity, especially in the anæmic, flabby types, and provided the relapse is

prevented by diet and exercise. Cabot (Medical News, Sept. 12, '96).

Tabloids of the whole gland-substance disagree in some instances, owing, no doubt, to the fatty matter they contain. Colloid tablets not prepared according to the method advocated by Dr. Hutchinson decidedly disappointing. Of the three sorts of tabloids used, those prepared according to Dr. Hutchinson's process the most efficacious. P. Jervis (Brit. Med. Jour., Oct. 2, '97).

Unpleasant and even serious symptoms observed after the administration of thyroid extracts; attributed to the presence of toxic decomposition products. By the employment of iodothyrin — an active principle of the gland—these unfavorable symptoms can be practically obviated. Used in seventeen cases of simple obesity, it brought about a reduction of weight without the aid of other treatment. In five cases there was diminution in weight after fifteen days' treatment. Lutaud (Coll. and Clin. Rec., Dec., '97).

Three cases of obesity in which was used a new preparation of thyroid gland known as thyroglandin. One grain was given three times daily for a few days. Dose was then rapidly increased until 9 grains were taken in the course of the day. Decrease in weight was rapid and persistent in all cases and was unaccompanied by the unpleasant symptoms so commonly experienced with other preparations used for this purpose. MacLennan (Brit. Med. Jour., July 9, '98).

The most serious disadvantage lies in the lack of permanency of its action. The most marked results are to be observed in the first weeks of the treatment, while after a few months the system may become so accustomed to the remedy that the patient not only ceases to lose his superfluous avoirdupois, but may actually regain much of the flesh lost. After cessation of the treatment there is quite commonly a strong tendency of the body to return to its previous condition. If we wish our treatment of obesity, either by the thyroid or diet, to be permanent, we must insist on a continuance of abstemious habits: a point on which the originator of the thyroid method, Yorke-Davies, lays especial stress. H. B. Wood, Jr. (Merck's Archives, July, '99).

Four cases of juvenile obesity treated with the thyroid extract. One a boy, aged 8 years, weighed before treatment 131 pounds. With purgation, diet, and exercise he was ordered 2 1/2 grains of thyroid extract three times a day, with a gradual increase until a 5-grain tablet was taken four times a day. After fourteen months' treatment he weighs 106 pounds and he has developed muscle to a considerable degree. I. N. Love (Jour. Amer. Med. Assoc., Apr. 21, 1900).

SYPHILIS. — Thyroid extract has not been extensively tried in this affection, but the few cases reported would seem to indicate that it assists alteratives, mercurials, etc., by stimulating metabolism. In a few cases thyroid extract apparently modified the syphilitic process independently of the usual remedies employed.

Case of syphilitic psoriasis. After five weeks' treatment by mercury and arsenic there was considerable improvement, but this line was stopped and the patient placed on thyroid. In three weeks the disease had disappeared, leaving only the usual pigmentation. John Gordon (Brit. Med. Jour., Jan. 27, '94).

Cases of malignant syphilis treated with thyroidin: cachectics, presenting squamous, ulcerous, osseous lesions, which had previously been treated in vain with mercurials and iodides. Thyroidin (dry extract of thyroid glands), 4 to 7 3/4 grains daily, in tablets, administered, suspending specific medication. Cutaneous and osseous lesions healed in part; even the pigmented spots of the skin were seen to disappear. Menzies (Brit. Med. Jour., July 7, '94).

Case of severe syphilis cured by ingestion of thyroid gland. Thirty grains progressively increased by same amount until 3 1/2 drachms taken at a dose. Every second day treatment interrupted twenty-four hours. Guladze (Wratsch, No. 30, '95).

TETANY. — The fact that tetany, as well as myxœdema, has not rarely been observed after extirpation of the thy-

roid gland has suggested the use of this remedy. It has seemed to be of value, especially in the idiopathic tetany of children.

> Form following total removal of thyroid gland a manifestation of acute myxœdema, and due to complete arrest of thyroid secretion. Thyroid extract curative. Common tetany may be due to lack of thyroid secretion. Thyroid treatment should be tried. Bramwell (Brit. Med. Jour., June 1, '95).
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> Case which presented none of the symptoms of myxœdema and possessed an apparently healthy thyroid gland. Tablets, 1 to 3 daily, consisting of 4 grains of thyroidin, used for about a month; the symptoms entirely disappeared. Four months later there had been no recurrence; hence it may be assumed that the cure was perfect. Max Levy-Dorn (Ther. Monat., H. 2, S. 63, '96).
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> 1. In the idiopathic tetany of children the administration of the thyroid gland is extremely useful; it always diminishes the intensity and the frequency of the attacks, and shortens the duration of the disease; it also notably hastens the arrival of the latent period which precedes recovery. 2. The treatment is well tolerated. 3. The organic exchanges, the digestive function, and diuresis are not notably influenced. 4. The circulatory and respiratory functions are accomplished normally. 5. In very young children, on account of their perfect tolerance, it is useful to administer the thyroid gland, raw or slightly cooked, internally. 6. With the exception of certain peculiar cases, it is not necessary to suspend the treatment from time to time. 7. The daily dose is from 30 to 60 grains. 8. This treatment is not opposed to the symptomatic treatment, as it does not present any incompatibility with the methods ordinarily employed. Leone Maestro (Riforma Medica, No. 116, '96).

Torticollis. — Spasmodic torticollis would also seem to enter within the field of thyroid-gland treatment, although a single case can do but little more than suggest its further trial.

> Case of spasmodic torticollis in which thyroid extract was used. History of four attacks of influenza. On leaving his bed after the third attack, neuralgic pains on the right side of the neck, right shoulder, upper arm and side; slight numbness in the legs. A few days later violent attack of pain, during which his head was drawn down toward the right shoulder. These attacks became frequent, eventually occurring as often as three or four times in an hour. The sterno-mastoid was slightly hypertrophied. Ordered 10-minim doses of thyroid extract to be taken three times in the day: equal to about one average-sized gland. After having taken 2 drachms of the extract, the attacks became less frequent, and were attended with less pain, and after taking about 2 ounces of it he suffered so little inconvenience that he discontinued the treatment. On a subsequent occasion, he was kicked by a horse on the outer right thigh; great tonic muscular spasm; considerable shock. For two days the spasm continued unabated. Thyroid extract renewed; after taking 30 minims the spasm became gradually less, and on taking the drug for two more days it completely subsided. H. H. P. Cotton (Brit. Med. Jour., July 24, '97).

Uterine Disorders.—Certain conditions influencing the genital apparatus —such as puberty, pregnancy, fibroid tumor, which cause a distinct change in the metabolism of the entire organism— very frequently cause an enlargement of the thyroid gland. Again, the deficiency of the normal thyroid secretion following thyroidectomy in myxœdema, cretinism, etc., is often associated with atrophic changes in the genital apparatus, as shown by Fisher, of Vienna. This sufficiently indicates direct association between the thyroid and the genital system to warrant careful investigation into the uses to which thyroid extract

might be put in the treatment of diseases of the reproductive tract.

> The deficiency of glandular substances in the economy experienced at the menopause seems to suggest that there is some lost principle which we may therapeutically supply until the system has gradually become accustomed to effect the necessary metabolism independently. Quite recently it has been claimed that iodine salts are always present in thyroid extract, which may partly explain the effect. Leith Napier (Brit. Gynæc. Jour., Aug., '96).
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> 1. The thyroid gland, in addition to its general effect upon the metabolism of the body, exerts an inhibitory action upon the pelvic genital organs, and upon the uterus in particular. This action seems to be especially marked upon the epithelial elements of the endometrium. 2. As a result of this inhibitory, or vasoconstrictor, action there follows a retardation of hæmorrhages from the uterine mucosa. 3. This action is directly antagonistic to that exerted upon the uterus by the ovarian secretion. 4. In cases in which this conservative influence is deficient or absent it may be restored by the ingestion of fresh thyroid gland or desiccations or extracts of that organ. 5. In gynæcology thyroid therapy is especially indicated in hæmorrhagic affections of the uterus and in all forms of pelvic congestion, notably in uterine fibromata, hæmorrhagic endometritis, menopausal hæmorrhages, and chronic tubal diseases. 6. The best results are to be expected in fibromata and pathological conditions of recent development. The more chronic the case, the more rebellious will it prove to thyroidization. 7. The thyroid influence is also found to cause an increase in the metabolism of the mammary gland, and the treatment is therefore indicated in all cases of insufficient lactation. W. A. Newman (Ther. Gaz., July 15, '99).

So far, thyroid extract has furnished marked evidence of its value for the purpose of arresting hæmorrhage whether this occur in connection with abortion, the menopause, tumors, or uterine malpositions. A remarkable case of metrorrhagia due to hæmophilia successfully treated with thyroid extract is reported by Déjace.

> Thyroid extract an excellent remedy in threatened abortion with hæmorrhage, and is valuable in preventing the arrest of uterine involution after childbirth. Chéron (Revue Medico-Chir. des Mal. des Femmes, Nov. 25, Dec. 25, '96).
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> Thyroid extract is particularly favorable in cases of uterine hæmorrhage. In purely functional cases the results had been a complete and lasting cure, also in the hæmorrhages of menopause or dependent on uterine malpositions. The growth of fibrous tumors is also checked by retrogression, and cure has followed its use early in the history of the cases. Jouin (Gynécologie, Oct., '97).
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> Case of hæmophilia treated by the thyroid substance. Face and mucous membrane absolutely colorless; the gums bled profusely at the least touch. The legs, arms, and the body were covered with spots of purpura. During each menstrual period the blood was discharged in an alarming abundance, and the menses lasted, on an average, from twelve to fourteen days. She had used all the hæmostatics without avail. Thyroid substance, three capsules a day, was begun on the 9th of October. On the 12th the menses appeared, and instead of continuing for twelve days, as before, lasted but four days and were moderate in quantity. On the 18th the loss of blood from the gums disappeared. Till the 27th the patient had had no hæmorrhage since the last menstrual period. The purpuric spots had disappeared and the gums and face had regained a rosy color. The thyroid substance exercises an action as yet unknown on the plasticity of the blood. M. L. Déjace (Indépendance Méd., Nov. 24, '97).
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> Case in which hæmophilic epistaxis was absolutely unaffected by ordinary therapeutic agents, and the epistaxis became so persistent and exhausting that permanent blocking of the nasal fossa was necessary. Treatment by thyroid extract exerted an immediate and beneficial effect, and was followed by

cure. In three days the violent and persistent epistaxis had practically stopped. In six days, about 8 grains of thyroid extract having been given daily, the purpuric eruption ceased and the old spots began to disappear. Scheffler (Archives de Méd. et de Pharm. Mil., March, 1901).

The internal use of thyroid extract recommended in increasing the coagulability of the blood. The writer believes it well worthy of an extended trial, either in cases of true hæmophilia, or where the coagulating time has been increased by disease. Three cases reported of operations in "bleeders" in which the administration of thyroid extract, for some days preceding operation, was followed by remarkable results in lessening the hæmorrhage at that time. Dr. Sajous believes that the thyroid extract stimulates the anterior pituitary body, which in turn excites the adrenals to greater activity, thus augmenting the proportion of fibrin ferment in the blood, and consequently its coagulating power. This explains the action in these hæmophilics, and its use is recommended as a preparatory treatment whenever surgical operation is to be undertaken in such persons. W. J. Taylor (Monthly Cyclo. of Pract. Med., July, 1905).

Cancer.—Thyroid has recently been tried in this affection, but the cases reported have been too few to warrant any conclusion as to its merits. Thus, D. McNicol, of Glasgow (Brit. Med. Jour., Nov. 9, 1901), after referring to an analysis of forty-nine cases thus treated, tried thyroid extract in four personal cases, and reached the conclusion that it did not even prolong life. In our opinion, the concomitant use of hypodermoclysis would have insured a better result.

Case of a woman who had a mammary tumor which was at first thought to be malignant. Thyroidin was given, and there was a rapid decrease in the size of the tumor, and it ultimately practically disappeared. Similar effects were observed in two cases in which there were large lymphomata and also in three cases of marked splenic enlargement without increase of leucocytes. Arthur Jaenicke (Centralb. f. innere Med., Jan. 12, 1901).

Case of widespread carcinoma in a woman, aged 44 years, in whom thyroid extract, in 5-grain doses varying from two to four times daily, given for six months, produced great amelioration of the symptoms. The symptoms returned, however, in spite of persistence of the treatment. P. B. Smith (Brit. Med. Jour., Feb. 16, 1901).

Case of uterine cancer in which the improvement followed so quickly upon the employment of the remedy, and was so striking, that in his own mind the author has not the slightest doubt that it was entirely due to its use, and he is certain that thyroid extract should always be given a trial in this class of cases before more heroic measures are adopted. H. A. Beaver (Brit. Med. Jour., Feb. 1, 1902).

The removal of the ovaries, provided they are actively functionating, frequently causes an arrest of the malignant mammary growths, and sometimes their complete cure. This action is materially aided by excision of as much as possible of the neoplasm, supplemented by the administration of thyroid extract in full doses. In women past the menopause, the excision of these organs is not so effective, while in others relief appears within twenty-four to forty-eight hours, and in favorable cases is rapidly progressive. The dose of thyroid extract that can be safely employed varies from 10 to 15 grains daily. Though this method should not result in perfect cure, it is the best palliative operative procedure yet devised. (Dorland.)

Two cases in which oöphorectomy plus the administration of thyroid gland had given successful results. In one case the treatment brought about the healing of a large carcinomatous ulcer of the right breast which had recurred after two operations for removal by surgical means, and had determined the disappearance of

a large tumor in the other breast, the nature of which was shown by the enlargement of the corresponding axillary glands, which glands also had ceased to be perceptible to the touch. G. Herman (Med. Press and Circ., Apr. 22, '99).

Dr. Herman's first case remains well twenty-five months after the operation and his second nine months after. Six other cases (treated by Dr. Beatson, Dr. Cheyne, and self) were disappointing failures. Perhaps thyroid was not steadily persisted in throughout all these cases, but it was given at first and would doubtless have been continued had it seemed to do good. Such facts as we have before us support (not establish) the view that oöphorectomy is by far the most important factor in the treatment, and that it may be the only one. Stanley Body (Lancet, Apr. 29, '99).

Thymus Gland.

This organ having been accidentally substituted for thyroid in a case of Owen's and benefit procured, it was found to produce analogous effects in other cases. This led Svehla to undertake a series of experiments to determine its physiological action. Injected into the femoral vein, thymus extract gave rise to a fall of blood-pressure, due to weakening or paralysis of the vasoconstrictors, and increase of pulse-rate, due to direct influence on the heart. When large doses were given there was excitement, followed by dyspnœa and collapse, ending in death, with post-mortem evidences of asphyxia. A certain analogy was thus shown to exist with the physiological action of thyroid, and this was further emphasized by the observations of Baumann, who found that the thymus contained iodine, as does thyroid, although in comparatively small quantities.

In the urine of dogs fed with thymus gland has been found a peculiar substance that has the formula approximately of $C_5N_6H_7O_2$ and which is believed possibly to be an imidopseudouric acid: that is, an oxidation-product of imidohypoxanthin. It is also possible that it is allantoin, and this seems to agree with some of its chemical reactions. It is important as perhaps contributing to the explanation of the form of uric acid derived from nucleinic acid. Minkowski (Centralb. f. innere Med., May 14, '98).

Dose.—The doses of thymus administered have been much larger than would be prudent in the case of thyroid. Of the gland proper the doses have ranged from 2 ½ drachms to 1 ounce, given three to five times a week; while the extract has been given in doses ranging from 30 to 60 grains.

Therapeutics.—Young sheep's glands should invariably be used; the glands of older sheep, having undergone fatty transformation, are, therefore, worthless.

GOITRE.—In this disease thymus seems to produce the same effects as thyroid gland, when administered in sufficiently large doses. In fact, from the results obtained it would appear that the thymus is but a thyroid six times weaker in curative activity.

Three cases in which diet of thymus produced good results: 12 to 15 (5 grains) tabloids given daily. Cunningham (N. Y. Med. Record, June 15, '95).

In the majority of the cases observed, a reduction in the size of the goitre and an amelioration or removal of unpleasant symptoms has taken place. Thymus is to be preferred to thyroid feeding. G. Reinbach (Mittheilungen aus den Grenzgebeiten der Med. u. Chir., B. 1, H. 2).

Ten cases of goitre treated with thymus gland, the ages ranging between 13 and 28 years. From 2 ½ drachms to ½ ounce of raw sheep-thymus were given on bread three times a week and increased to 7 drachms. In one case of small goitre complete recovery was effected within two weeks. In six cases there was a marked reduction. In two cases there was slight improvement; one was not benefited. Mikulicz (Berliner klin. Woch., Apr. 22, '95).

Thirty cases of goitre treated with thymus extract. In twenty decided re-

duction followed, and the general symptoms were improved. Among these were a number of cases but slightly improved or aggravated by thyroid treatment. A complete cure was obtained in but two cases. Mikulicz (Centralb. f. Chir., p. 929, '96).

EXOPHTHALMIC GOITRE. — In exophthalmic goitre improvement is reported to have been obtained in about one-half of the cases treated, but there is a striking lack of concordance between the various reports, some authors reporting series of cases in which all cases were materially benefited, others reporting failures on all sides. In a recent paper Hector Mackenzie described a series of experiments having for their object to determine the actual status of the question. He compared results obtained in 15 cases in which thymus was used by other physicians to 20 cases under his own charge. In the 15 cases from other sources there was marked general improvement in no less than 14; in 7 the pulse-rate was markedly diminished; in 3 there was complete and in 4 partial disappearance of exophthalmos. Of the 20 personal cases, 1 died; in 6 there was no improvement; in 13 slight improvement. As to the pulse-rate, in 12 there was no change; in 2 it was increased; in 5 it was slightly and in 1 markedly diminished; but in this 1 the improvement was merely transitory. Of 20 other cases in which remedies other than thymus were employed, in 11 there was no change, in 2 slight increase, in 4 markedly and in 3 slightly diminished pulse-rate; so that, from the side of the heart, there was no special benefit from the thymus. As to the goitre, in 3 cases there was material diminution in size, and in 3 enlargement from thymus. Of the 20 contrast cases: in 13 there was no change, in 4 cases more or less diminution, in 1 complete disappearance, and in 1 enlargement. The balance, therefore, is against the thymus treatment. As to the exophthalmos, diminution occurred in only 1 case, and this commenced before thymus was tried. In the 20 contrast cases, 3 lost the exophthalmos. In the matter of general nutrition there was a slight weight in favor of the cases under treatment by thymus. Williams reported a case in which the symptoms were perceptibly aggravated and Kinnicutt, in two test-cases carefully watched, could observe no improvement.

Case treated by raw sheep's thymus in doses of 2 ½ drachms to 7 drachms in gradually increasing doses about three times weekly. The subjective symptoms —the exophthalmos and tachycardia— were all diminished, but the goitre and tremor remained unchanged. Mikulicz (Berliner klin. Woch., Apr. 22, '95).

Case treated with capsules of dried thyroid, continued nearly two months without any perceptible influence upon her condition or upon the secretions, urea and uric acid being quantitively examined. After trying potassium bromide, nuclein, and an extract of spleen without favorable result, the patient, on July 15th, began to take capsules of dried aqueo-glycerin extract of the thymus gland, 3 a day, each of which contained 1 ½ grains. On August 5th feeling much better, although there were no obvious changes in the symptoms; on September 7th she was discharged relieved. After having stopped the use of the thymus, in about four weeks after leaving the hospital, she was again provided with capsules to take twice a day. On December 6th the pulse was 92. Improvement; swelling of the thyroid less, and patient able to work. R. T. Edes (Boston Med. and Surg. Jour., Jan. 23, '96).

Case of exophthalmic goitre which, in spite of all treatment, became steadily worse. Thymus-gland medication was begun and continued with the best results. The patient felt so well that, the supply of tabloids being finished, she

stopped the treatment, and in a few weeks the exophthalmos was back again to a considerable extent. The tabloids were resumed, and in a short time their benefit was noticeable. N. J. McKie (Brit. Med. Jour., Mar. 14, '96).

Four cases treated by thymus. It certainly does improve the deranged heart-action, but it seems more particularly to lessen the gastro-intestinal symptoms and the tremor and general muscular weakness. Three of the cases had presented great psychical alteration; in all of them the mental state has improved readily. A. Maude (Lancet, July 18, '96).

Case of exophthalmic goitre in a girl of 22. Pulse, 156 and very irregular, both in force and frequency. Thirty grains of dried thymus in the form of tabloids given daily, and on the third day the pulse had fallen to 130 and was quite regular. The amount of thymus was gradually increased to 100 grains daily; at the end of three weeks the pulse had fallen to 73 and was regular. The size of the thyroid was not diminished, but the exophthalmos was less marked. C. Todd (Brit. Med. Jour., July 25, '96).

Three cases of exophthalmic goitre treated with thymus gland. All three were restored to health by the treatment. The dose of the raw gland was from half an ounce to an ounce three or four times a week. In one of the cases discontinuance of the gland was followed by relapse, but on resuming it the patient again improved. Upon one occasion a patient who always had been benefited by the treatment failed to respond to the glands. This was found to be due to their having been taken from full-grown sheep. On giving calves' thymus most urgent symptoms were at once relieved, especially dyspnœa, palpitation, and tremors. David Owen (Lancet, Aug. 22, '96).

Case of twenty years' duration in which ordinary remedies were tried without benefit. Raw thymus obtained from the lamb, in doses of 2 drachms daily for three months, caused the cardinal symptoms to disappear. The treatment was discontinued after seven months. Three months later there was a return of goitre, tachycardia, and slight exophthalmos. He resumed the thymus, taking ½ ounce or more of the raw gland three or four times a week. After three months the exophthalmos and goitre had quite disappeared, the pulse, instead of 120 and over, was 72. The following autumn the patient was unable to take the gland any longer, on account of its nauseating effects. At the end of three months the old disease was returning. He again resorted to the thymus, but took it for two months without any effect whatever. Lambing season corresponding to the spring, however, the failure of the glands doubtless due to the fact that the glands had been taken from older sheep than before. Calf's thymus tried, lamb's not being obtainable. For some time the patient was worse; but, during severe suffering he took about ½ ounce of calf's thymus, and repeated the dose in the morning. During the following week he improved remarkably. The improvement continued during the winter, but there was a return of symptoms this summer. Now suffers from occasional palpitation, sense of weakness, and low spirits, and some prominence of the eyes. David Owen (Brit. Med. Jour., Oct. 10, '96).

Case of a girl, 21 years of age, who had applied for treatment for palpitation of the heart, prominence of the eyes, and swelling in the neck, first been observed two years ago. All three symptoms were less striking than before the use of thymus gland, begun two months before report. C. E. Nammack (Med. Record, Apr. 17, '97).

Improvement in six out of twelve cases of exophthalmic goitre. The goitre, exophthalmos, and palpitation were improved, and nervousness, insomnia, and tremor very much relieved. Solomon Solis-Cohen (Amer. Jour. Med. Sciences, p. 132, '97).

The best results in the treatment of exophthalmic goitre can be obtained from the joint administration of thymus and suprarenal substances. Solomon Solis-Cohen (Phila. Polyclinic, Sept. 7, '98).

Marked case of Graves's disease, rebell-

ious to other treatment for three years and threatening melancholia, improved in a week and practically cured in three months, with 15 to 25 grains of extract of lamb-thymus a day. The only symptom left was a slight enlargement of the thyroid. C. E. Boisvert (Revue Méd. de Montreal, June 21, '99).

Four cases of exophthalmic goitre treated with thymus extract. In two no perceptible effect was obtained. In the two others there was considerable improvement amounting practically to a cure in one case. W. R. Parker (Brit. Med. Jour., Jan. 7, '99).

From the cases narrated, there is reason to believe that further use of thymus or its preparations will demonstrate that it is superior to thyroid in exophthalmic goitre, although it may not prove more efficacious than the remedies usually employed in the treatment of this disease.

Suprarenal Extract.

To try to establish the therapeutic application of suprarenal gland or its preparations upon a solid foundation for the present would be a futile effort, physiologists having not, as yet, fully determined any of the purposes of the organs themselves in the human economy. Quoting Horatio C. Wood (1896), "The functions of the suprarenal capsules still remain a mystery. This only is certain: that disease of these capsules is followed by a progressive asthenia, a peculiar bronzing of the skin, and loss of digestive power with excessive vomiting," while Stockman, referring to its secretion, wonders whether its absence leads to a toxic condition of the blood which poisons the other tissues, or whether the want of it leads directly to an atonic state of the whole muscular system. These, he thinks, are questions which, for the present, must be left open, along with many other important points, such as the origin of the pigment, etc., which are still very obscure.

As previously stated, this work is intended to portray the prevailing views of the profession, and not our own doctrines, pending confirmation of the latter. The interpretation of Auld (Brit. Med. Jour., June 3, 1899) presents, in the aggregate, the conclusions to which other investigators have been led:—

"The available evidence goes to show that the suprarenal acts by destroying deleterious substances, and also by furnishing a material to the blood. As the work seems to be done by the medulla, there is considerable ground for regarding the vasoconstricting substance as evidence of the former function."

Physiological Action.—There is good ground for the belief, however, especially since the experimental investigations of Brown-Séquard, Abelous, Langlois, and Dubois, that the physiological function of the suprarenal capsules is to transform or to destroy the toxic substances which are produced in the organism under the influence of muscular activity and of the nervous system. The destruction of these organs is thought to be capable of causing in the organism an accumulation of toxic agents which is the principal cause of the sensation of extreme fatigue and of the profound and generalized asthenia experienced by patients who suffer from Addison's disease.

The evidence that the suprarenal capsules contain a toxic substance of great activity, much more active than that of any other gland, seems quite conclusive.

Extracts made from the suprarenal glands of the calf, sheep, guinea-pig, cat, dog, and man have a similar action. Diseased glands from cases of Addison's disease were found by them to be inert. The active principle, whatever it is, must therefore be recognized as an exceedingly powerful body, if we reflect

that of this ¼ grain about 80 per cent. is water, and another very large proportion must consist of the proteids, etc., of the gland-substance. Oliver and Schäfer (Jour. Physiol., vol. xviii, pp. 230-276).

The administration of the suprarenal extract slows the pulse by stimulating the pneumogastric. It strengthens the cardiac systole by direct stimulation of the heart muscle and by stimulation of the cardiac ganglia. It causes an increase in blood-pressure due to contraction of the capillaries through stimulation of their vasomotor nerves and muscle-fibres and by action upon the vasomotor centre. It blanches and causes an anæmia of the tissues. A. Goy (Revue Française de Méd. et de Chir., No. 3, p. 64, 1904).

The experiments of Dubois would tend to show that the toxic substance isolated is identical to muscle-toxin: *e.g.*, originating in the muscles. Being foreign to the capsules themselves, these organs would have the destruction of the toxic products as their physiological function. Several albumoses found in the capsules which in themselves seem to possess no well-marked toxic properties would, according to Dubois, possess the properties presented by the organ when used as a remedy.

Toxic substance separated from the gland, soluble in alcohol, which caused death in rabbits from respiratory failure. It had no paralytic action, but seemed to act on the central nervous system. Gourfein (Bull. de l'Acad. de Méd., p. 331, '95).

If suprarenal bodies of the calf, sheep, or dog were injected, even in very small quantities, into a vein in a dog or a rabbit the following pronounced physiological effects were produced: 1. Extreme contraction of the arteries, which was shown to be of peripheral origin. 2. A remarkable and rapid rise of the arterial blood-pressure, which took place in spite of powerful cardiac inhibition, and became further augmented when the vagi were cut. 3. Central vagus stimulation so pronounced that the auricles came to a complete stand-still for a time, although the ventricles continued to contract, but with a slow, independent rhythm. 4. Great acceleration and augmentation of the contraction of the auricles and ventricles after section of the vagi,—the auricular augmentation being especially marked. 5. Respiration only slightly affected, becoming shallower. G. Oliver and E. A. Schäfer (Jour. of Physiology, Apr., '95).

The active principles of adrenal divided into two classes: (1) several albumoses which are precipitated with alcohol and redissolved in water and which when isolated have no well-marked toxic effect, but which alone possess the property of destroying toxins, especially those originating in muscular tissues; (2) a class composed of bodies which resemble in their constitution and reactions the alkaloids, having a marked degree of toxic effect resembling muscle-toxins. Dubois (Arch. de Phys. Norm. et Path., vol. viii, p. 412, '96).

The active substance contained in the medullary portion of the capsule and the activity of the extract shown to run parallel with the distinctness of certain color-reactions (*e.g.*, a green with ferric chloride), which are due to a substance which has not yet been isolated in a pure state. Fraenkel (Wiener med. Bl., '96).

Experiments showing that after section of the medulla and extirpation of the spinal cord, the injection of suprarenal extract is capable of prolonging life of the animal, which would otherwise quickly succumb. Strickler, in 1877, proved that extirpation of both the cervical and thoracic parts of the spinal cord caused instantaneous stoppage of the heart's action. Biedl (Lancet, Mar. 21, '96).

The marked stimulation of the heart and arterioles is probably due to an action on their intrinsic nervous ganglia rather than to a direct action on the muscular fibres. As previously observed by Cybulski, administration of the extract by the mouth or subcutaneously

has very little effect on the circulation as compared to what is observed after intravenous injection. Obviously, the active principle is destroyed by the tissues. Gottlieb (Arch. f. Exper. Path. u. Pharm., B. 38, '96).

Researches into the constitution of the blood-pressure-raising constituent of the suprarenal capsule showing that it is to be classed with the pyridine bases or alkaloids, and that it is not possible to split off pyrocatechin from the isolated active principle. This view is the opposite of that of Mühlmann, who supposed that the blood-pressure-raising constituent was pyrocatechin joined to some other substance, probably an acid. Abel and Crawford (Johns Hopkins Hosp. Bull., vol. viii, p. 151, '97).

The extraordinary rise in the blood-pressure after intravenous injection of suprarenal extract is due to stimulation of the vasoconstrictor nerves: the centres in the brain as well as the ganglia in the blood-vessels. The suprarenal extract paralyzes the vagus nerve and the cardiac depressor. It, on the other hand, stimulates the central as well as peripheral ends of the accelerators. The temporary retardation of the heart-beat is produced by the momentary stimulation of the pituitary body, which is brought about by the sudden rise of the blood-pressure in the skull. Cyon (Pflueger's Arch. of Phys., vol. lxii, p. 370, '98).

The two drugs which most promote contraction of the arteries, and in consequence must antagonize the dangerous fall of blood-pressure produced by chloroform, are atropine and extract of suprarenal capsule. Extract of suprarenal capsule remarkably increases the rate and the force of the heart-beat. Schäfer (Lancet, Feb. 5, '98).

The most useful application of the suprarenal extract will be in cases of cardiac weakness and threatening collapse. Mankovsky (Russian Arch. of Path. Clin. Med. and Bact., Mar., '98).

The medulla of suprarenal capsules contains a chromogen, possibly allied to tannin in coffee, and an active principle which chemically appears to be closely connected with piperidine. This latter has a remarkable effect upon the muscular tissues, generally increasing their tone, and producing, when injected intravenously, an enormous rise in blood-pressure. Swale Vincent (Birmingham Med. Rev., vol. xliii, No. 236).

Experiments of Biedl and of Gottlieb repeated. Conclusion that the use of suprarenal gland in the lower animals does much toward preventing accidents during the administration of chloroform, probably through its powerful influence on the vascular system. Minkowsky (Revue de Thér. Méd.-chir.; Ther. Gaz., Dec. 15, '98).

Suprarenal extract in dogs stimulates the vagus centre, thus inhibiting the heart. It produces also a direct stimulation of the heart-muscle, resulting, when the vagus influence is removed, in an increase in the force and frequency of its beat. Accompanying the heart-action there occurs a rise in the systemic blood-pressure due to the contraction of the arterioles. The pressure in the pulmonary arteries, however, is not raised, these vessels not being acted upon as are the others. Wallace and Mogk (Boston Med. and Surg. Jour., Jan. 26, '99).

Epinephrin, the active principle of the adrenals and the commercial adrenalin, may practically be considered alike. Injected subcutaneously, intravenously, intraperitoneally, or into the spinal canal, epinephrin in large doses causes repeated vomiting, excitement, and general weakness, which may end in complete prostration, bloody diarrhœa, and death. The findings at autopsy are characteristic. Death may be caused by cardiac or respiratory paralysis or by both. The lethal dose lies between 1 and 2 milligrammes, per kilogramme, intravenously. The subcutaneous lethal dose lies between 5 and 6 milligrammes, the intraperitoneal between 0.5 and 0.8 milligramme. S. Amberg (Arch. Internat. de Pharmacodyn., vol. xi, fasc. 1 and 2, 1902).

Prolonged contact of the blood with the extract does not deprive the latter of its effect on the blood-pressure. Intravenous injections of adrenalin in rabbits in which the blood-vessels of one ear were deprived of the vasomotors showed a blanching of the ear of the

operated side which lasted longer than that on the normal side. Following this the normal ear became perceptibly more congested than before the injection. This seems to show that the extract favors vasodilation when the central nervous influence is intact; when the latter is absent, constriction results. The authors also demonstrated that subcutaneous injection in the normal animal had no effect on the pupil and very little constricting effect on the blood-vessels, but when the sympathetic nerve was cut the pupil remained dilated for a considerable time, and vascular constriction also lasted for an equal period. S. J. and C. Meltzer (Amer. Med., Feb. 7, 1903).

Therapeutics. — Suprarenal therapy has now exceeded thyroid therapy in far-reaching application. Indeed, suprarenal extractives seem endowed with properties which Bates summarizes by the word "marvelous." Unlike other potent agents, they are devoid of pernicious after-effects. The author just named states, for example, that, while we expect great dilatation of blood-vessels to follow powerful contraction, "in 2000 cases noted in which the suprarenal produced this contraction the expected dilatation did not occur." Again, though a drug which, in minute doses, produced powerful effects is deemed a poison, such cannot be said of pure adrenal products. "No untoward effect," he writes, "has ever followed the local or internal administration of the untainted gland. Two pounds of the fresh suprarenal capsule in the form of an aqueous extract has been swallowed without any apparent ill effects." Its application to the eye does not cause irritation, and it does not cause dilatation or contraction of the pupil. It is not cumulative when taken internally, and it does not possess attributes which involve the danger of a "habit," as do cocaine, alcohol, etc.

We cannot agree with Dr. Bates when he states that no untoward effects ever follow the local use of adrenal extract. There sometimes occurs overdistension of the sinuses of the turbinals, for instance, as noted by Kyle and others, and secondary hæmorrhage is more likely to follow its use.

> The extract, applied locally, reduces congestion and is of especial benefit in rhinitis and hay fever. Eye: Local application lessens congestion in conjunctivitis, keratitis, and iritis, and hastens the absorption of inflammatory tissue. In lacrymal stricture and abscess the writer injects a solution of the extract through the "puncta." The vascularity is rapidly diminished, and any pus present may be expressed via the canal. Ear: Locally applied to the Eustachian tube, the congestion is reduced and deafness and tinnitus disappear. Its hæmostatic properties are well known, and it can be used thus with confidence, as no clots are formed. In Addison's disease and asthma it has given good results, and 2 grains of the dried extract internally in exophthalmic goitre will lessen the heart-rate and decrease the size of the thyroid. The normal heart is not affected when given internally, neither the normal blood-pressure nor pulse, but an intermittent pulse becomes regular, a weak pulse stronger, and feeble cardiac muscle remarkably stimulated. All the effects produced are only temporary, so that repeated applications are necessary. But in all forms of inflammation it is very useful in reducing tension and allaying pain. Bates (Med. News, p. 441, Mar., 1900).
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> After the use of suprarenal extract there is danger of secondary hæmorrhages, which come on several hours after the operations, and are often so profuse as to alarm the patient. Conclusions are that there is a likelihood of having more profuse secondary hæmorrhages after the use of cocaine and suprarenal extract than after the use of cocaine alone. F. E. Hopkins (Phila. Med. Jour., May 5, 1900).

This does not, however, reduce the therapeutic value of adrenal extractives.

Solutions of adrenal extract, or of its more convenient preparations on the market (epinephrin, adrenalin, etc.), in 1 to 1000 or 1 to 5000 solution arrest epistaxis and limit hæmorrhage during intranasal operations, while greatly increasing the operative field by contracting the tissues. The solution is to be applied with a pledget of cotton and left *in situ* about five minutes, when the tissues are blanched and ready for operative work. It may also be applied in the form of a spray in hay fever and local inflammatory disorders, 1 part of adrenalin in 6 of the normal salt solution is to be preferred in the latter.

Thirty-five cases in tabulated form, showing that the useful effects of the suprarenal gland were obtained. In two cases the nose was not packed, but the patients were placed in bed and kept quiet for two days and adrenalin, 1 to 10,000, was applied by means of spray every two hours. There was no subsequent hæmorrhage in either of these cases. The author has employed no suprarenal extract since taking up the use of adrenalin. Emil Mayer (Phila. Med. Jour., April 27, 1901).

Great relief and almost complete comfort from the topical use of adrenalin solution applied on a cotton wad, or as a spray in the proportion of 1 to 5000. S. Solis-Cohen (Amer. Med., Sept. 7, 1901).

The following solution is a valuable local application in hay fever, and is also remarkably efficient in controlling inflammation or bleeding and in producing anæsthesia of the mucous membrane:—

℞ Adrenal, 20 grains.
Phenic acid, 2 grains.
Eucaine-B, 5 grains.
Distilled water, 2 drachms.

Macerate ten minutes; filter.

This solution is permanent, will not decompose nor lose its physiological activity for several months. Somers (Merck's Archives, June, 1900).

The best way of applying solution adrenalin chloride is in conjunction with a 2-per-cent. solution of cocaine. In the nose a pledget of cotton saturated with a 2-per-cent. solution of cocaine should be allowed to remain in contact with the tissues not longer than two minutes, and its use should be immediately followed by the similar application of solution adrenalin chloride. Prior to operative procedures the 1 to 1000 or the 1 to 2000 solution should be employed; for the relief of local congestion the 1 to 10,000 will give the most satisfactory results. The adrenalin pledget should be left in contact with the tissues for ten to fifteen minutes, depending upon the result desired, as well as the amount of swelling to be reduced. D. Braden Kyle (Therap. Gaz., July 15, 1902).

In cases of obstruction from any cause the nasal passage is packed with cotton-wool saturated with adrenalin-chloride solution. When the swelling has been reduced the membrane should be cocainized and the passages explored, until the cause of the trouble is located, when the operation may be performed with safety. D. S. Reynolds (Med. Mirror, Aug., 1902).

In pharyngeal and laryngeal inflammations a solution of 1 to 10,000, gradually increased to a 1 to 2000, is often of advantage applied in the form of a fine spray. It may also be painted over inflamed tonsils with a camel's-hair pencil or a pledget of absorbent cotton.

Case of acute laryngitis with œdema of the glottis, in which there was great swelling and redness of the epiglottis, with difficult respiration, which seemed likely to necessitate a speedy tracheotomy. The interne was directed to apply to the larynx, every three or four hours, a spray of 1 part of adrenalin to 10,000 normal salt solution. This was done, with the effect of giving the patient speedy relief. He said that he felt as though the parts had been contracted. In addition to this treatment the patient was given 1/4 grain of nitrate of pilocarpine, which caused free salivation and profuse sweating. This was repeated twice a day for two days; therefore it cannot be said just what

the influence of the adrenalin was; however, its immediate effects were good, as demonstrated several times. The patient made a speedy recovery. E. Fletcher Ingals (Jour. Amer. Med. Assoc., April 27, 1901).

A few minutes' application of a solution of adrenalin chloride (1 to 1000) to the mucosa of the respiratory tract makes possible an absolutely bloodless operation; its value as an adjunct in operative procedures cannot be overestimated. It has a wide field of usefulness as a therapeutic agent because of its rapid and safe contraction of the superficial capillaries. The author has found the 1 to 1000 solution useful in acute and subacute laryngitis, especially in the case of vocalists. A simple congestion of the larynx may be reduced readily and vocalization restored without discomfort or irritation. M. A. Goldstein (St. Louis Med. Rev., Aug. 16, 1902).

Internal Administration.—Suprarenal substance and extractives have been used internally with more or less advantage in inflammatory disorders of the respiratory and cardiac systems, including asthma, bronchitis, hæmoptysis, and in exophthalmic goitre, malaria, diabetes, and mental disorders. As is the case with thyroid substance and its extractives, suprarenal substance and its extracts are not destroyed in the digestive process.

The use of suprarenal powder in diseases of the heart in one hundred cases warranted the following conclusions: After the administration of the suprarenal powder the following was observed: 1. A weak and irregular acting heart became stronger and more regular. 2. A dilated heart was contracted. 3. A diffused apex-beat became localized. 4. A diffused, loud, and rough mitral regurgitant murmur became localized, smoother, and lessened in intensity, while in some cases the murmur disappeared. 5. A murmur which, owing to the extreme weakness of the heart, could scarcely be heard, became more distinct, thus aiding in the diagnosis. 6. The normal cardiac sounds, when distinct, became clearer and more easily distinguished. 7. In some cases a rapid pulse became less rapid; in other cases a slow pulse became faster. 8. Patients who were very weak, with organic heart disease, were improved. 9. No effect was observed in organic heart disease when the pulse was strong and regular. Three grains of the powder were found effective, but larger doses proved harmless. Samuel Floersheim (New York Med. Jour., May 4, 1901).

The chief physiological action of suprarenal-gland extracts is increase of arterial pressure, but they also produce a tonic effect upon the heart and on muscle generally and possibly some diminution of metabolism. Owing to the transitory nature of the effects produced by intravenous injection of the extracts, they must be given by the mouth if any prolonged action is to be obtained. Digestion is not impaired by moderate doses. Both for *a priori* reasons and as a matter of experience they appear to be indicated in conditions of excitement and exaltation, in which state the blood-pressure is usually lowered. In mental diseases administration for a certain length of time will be found necessary in most cases to produce marked effect where excitement is violent. Although the state of the blood-pressure, as a rule, forms a convenient indication for their use, high pressure does not absolutely contra-indicate them, if there is some reason to think that it is not associated with the mental state, as an abnormally high pressure may still be lower than the average of an individual case. Suprarenal extracts seem unlikely to be of benefit in cases of melancholia and where there is much stupor. It therefore seems probable, on the whole, that the psychoses in which this will be found most useful is in acute mania of fairly recent origin uncomplicated by stupor. W. R. Dawson (Jour. Mental Science, Oct., 1901).

Two cases of neurotic heart in which the use of adrenalin, in doses of 20 minims of the 1 to 1000 solution, was productive of marked benefit. Myrtle (Brit. Med. Jour., Apr. 30, 1904).

Addison's Disease. — Imperfect action of the suprarenal capsules implying, in the light of our present knowledge, a gradual toxæmia by the products of metabolism, it was thought that the ingestion of the organ or its extracts would prove curative. So far, no cases of final cure can be said to have been witnessed, but several cases have remained well under the continued use of the remedy for a considerable time; some of these, however, have had sudden recurrences, terminating fatally. It is quite evident that the entire question is still very obscure, but it is also certain that the use of adrenal or its preparation merits further trial, especially in the earlier stages of the disease and when the presence of a tubercular process cannot be absolutely recognized.

Case in which the patient's condition was critical in the extreme, her pulse was very rapid (120 to 150 per minute) and hardly perceptible. She was in a comatose condition for nearly a week. During that time she was fed through a nasal tube and stimulated with brandy and hypodermics. On the fourth day after the commencement of the convulsions, adrenalin chloride (1 to 1000) was administered in 5-minim doses, three times a day. Consciousness gradually returned and the circulation began to improve. There was no return of the convulsions and in two weeks the dose was increased to 10 minims. At the end of a month the patient had improved wonderfully and the pulse was 80 to 90 per minute, fuller and stronger, and there was a distinct diminution in pigmentation. The dose was increased to 20 minims and later to ½ drachm, three times a day, but it had to be reduced, from time to time, on account of the pulse becoming too small. The patient has steadily improved in strength and weight, and is now, eleven months after the commencement of the treatment, able to be about. There has been no recurrence of the fainting spells or gastro-intestinal disturbances. H. M. Raven (Brit. Med. Jour., Jan. 16, 1904).

Ophthalmology. — In inflammatory diseases of the eye, the active principles of suprarenal have the power of suddenly stimulating the vasomotors, thus depleting the engorged vessels. In a method recommended by Barraud, sheep-capsules are used, and with the product of evaporation a solution is prepared with equal quantities of sterilized water; this is done, as much as possible, at the time of using, for the solution becomes rapidly altered. One drop of Barraud's suprarenal solution instilled into the eye produces an energetic vasoconstriction of the conjunctiva at the end of thirty to forty seconds. In a few minutes this action is sufficiently marked to cause pallor of the mucous membranes, and continues about twenty minutes, after which the vessels return to their former condition.

In ophthalmology, therefore, the aqueous extract of suprarenal capsules finds its application as follows: 1. In conjunctivitis, kerato-conjunctivitis, vascular keratitis, episcleritis, and glaucoma as an aid to the usual medication. 2. In cases in which extreme inflammation of the tissues and intense congestion of the media of the eye limit the action of cocaine, it regains its analgesic power, owing to the ischæmia previously produced by the suprarenal extract. 3. Finally, whenever there is reason to fear a hæmorrhage during surgical intervention on the eye, the extract acts either as a preventive or as a radical hæmostatic agent. (Maurange.)

Dor was first to recommend the application of suprarenal extract in cases where, an operation being urgent, it was difficult to obtain local anæsthesia with cocaine alone, owing to hyperæmia of the conjunctiva. (Darier.)

The method for preservation of suprarenal solutions employed for over a year now in Buffalo with excellent satisfaction is as follows: One-half gramme of the extract of suprarenal capsule is rubbed to a paste, the water is added gradually until there is a solution of 1 ounce. This is then heated for some time to 160° F. Water being constantly added as the solution evaporates so as to keep the amount of liquid always up to 1 ounce. Fifteen grains of boric acid are then added and the solution is ready. It will keep for weeks. The suprarenal extract is used in the eye in the shape of small wafers. To make these the extract is rubbed up into a paste and then mucilage added to give it consistency. These feel somewhat rough, but are unirritating when moistened. The addition of formalin, 1 to 10,000 or the employment of a concentrated extract in glycerin diluted as required are good methods for preserving the substance. But both the formalin and the glycerin have proved irritating to some eyes. Lucien Howe (Med. News, Mar. 24, 1900).

Adrenalin may be employed in very dilute solutions in the form of a collyrium with boric acid. One drachm of the 1 to 1000 solution in 2 ounces of distilled water, with 10 grains of boric acid, is effectual when frequently used. To relieve the congestion, irritation, and lacrymation caused by ordinary conjunctivitis, and to combat blepharospasms. To relieve trachomatous pannus. To enhance the action of cocaine, atropine, eserine, and pilocarpine, by promoting their absorption. Adrenalin is first used, followed during the period of blanching by the drugs named. To reduce the tension in trachoma. To facilitate the introduction of lacrymal sounds, the solution being first injected into the ductus ad nasum. To relieve ciliary pain in keratitis, iritis, and cyclitis with glaucoma. To modify opacities of the cornea. To produce cosmetic effect. G. E. de Schweintz (Therap. Gaz., July 15, 1902).

Combined with adrenalin cocaine will render great service in conjunctivitis and lessens the pain of topical applications as well. Its use makes catheterization of the tear-duct unnecessary, for a simple injection does away with the stenotic action of the mucous membrane. When eserine or atropine fail in their usual action upon the pupil, combination with adrenalin obviates the difficulty. Its use facilitates operations upon the conjunctiva because of the ischæmia which it produces, but after iridectomy its employment may be followed by hæmorrhage into the anterior chamber. In corneal lesions, such as ulcerations, it should not be used, but in episcleritis it produces excellent results. Darier (Revue de Thérap., No. 9, p. 313, 1904).

GENITO-URINARY DISEASES.—In disorders of the urethra and vulva suprarenal extract has recently been found of considerable value. Its effects are similar to those produced upon the tissues of the upper respiratory tract. A 1 to 10,000 solution was also found by Fritsch greatly to facilitate cystoscopy and operative procedures in the bladder.

Adrenalin is indicated in cases of mucous or muco-purulent discharge; when the urine shows mucus or flat, scaly shreds and mucous shreds; when endoscopical examination shows granular patches or superficial scleroses; when pus-cells, epithelium, mucous gonococci, or other micro-organisms are present. Series of cases of urethritis which had resisted other drugs, and which were, with few exceptions, benefited by instillations of adrenalin chloride, 1 to 1000. The field of usefulness of this drug in urethral work is limited to the same indications as for mucous membranes in other localities. It is painless to apply, and causes a cessation of secretion by contraction of the blood-vessels for a varying time. It will only act, however, on superficial lesions, and will bear watching for untoward action. S. E. Gans (Phila. Med. Jour., Dec. 13, 1902).

In two cases of pudendal irritation, attended with marked pruritus, suprarenal extract gave marked relief. In the one, a young woman 18 years of age, violent itching of the vulva and

anus had come on ten days before. Notwithstanding usual methods of treatment, there was no relief, and in the meantime the condition had become so severe that she was unable to leave the house. A local examination showed an intensely congested condition of the vulva and the lower part of the vagina, with increased secretion. A strong solution of suprarenal extract was applied to the part, which was followed by a rapid blanching of the mucous membrane. Momentarily the itching was increased, and then gave way to a slight burning sensation, which passed off in a few minutes. The effect of this application lasted for fourteen hours, when the itching recurred. A second application cured the case. F. S. Meara (Merck's Archives, May, 1902).

The effect of adrenalin upon the uterine mucosa is not the same as on that of the vagina. In the excision of portions of the mucosa from the vaginal wall in colporrhaphy, no loss of color occurs in the mucosa, nor any decrease in the usual amount of bleeding. The vaginal mucous membrane, in fact, does not react to the direct application of adrenalin. On the other hand, when the portio vaginalis or cervical mucosa is treated with the preparation, the blood lost (for instance, in curetting) is much less; the red portio assumes a blue color, the curetted material is pale, and the hæmorrhage, compared with what it usually is, is reduced to a minimum. Fenomenoff (Therapie, No. 1, 1904).

Pituitary Extract.

Lesions of the pituitary body having been found in almost all autopsies in cases of acromegaly, a close connection between this organ and the symptoms of the disease could but be inferred; it also suggested the use of the gland as a remedial agent soon after the animal extracts entered the field of therapeutics.

Physiological Action.—Although Mairet and Bosc found that triturated or macerated gland was practically inert in man as well as animals, producing rise of temperature and emaciation, Schäfer and Oliver found, to the contrary, that it was quite active, affecting mainly the arterioles and heart-muscle. It is thought to bear some undetermined relation to the nutrition of bone or dermal tissues.

> Rapid and great rise of blood-pressure observed, bearing directly upon the arterioles and probably upon the heart-muscles. The pituitary body furnishes a secretion to the blood which serves to increase the contractile power of the heart and arteries and to influence the nutrition of certain tissues. Schäfer and Oliver (Jour. of Phys., p. 277, '95).

> In animals (rabbits), excepting disturbances evidently due to local infection produced by the subcutaneous injections, very slight effects were obtained: a transient elevation of temperature, most marked two hours after the injection. Injected into the veins it produced disturbances similar to those obtained after injection of blood, namely: death from coagulation. If treated by sodium chloride or by heat it produces results similar to those of blood-serum when similarly treated, but it is distinguished only by a more marked myosis; and given by the mouth, macerated or triturated pituitary gland causes, besides a slight elevation of temperature, a noticeable gastro-intestinal disturbance and a temporary albuminuria, showing that this substance possesses only a slight degree of toxicity. With dogs nothing of importance is noticed: slight emaciation and slight elevation of temperature. With healthy men the same results were reached. Mairet and Bosc (Arch. de Phys., No. 3, p. 600, '96).

> The pituitary gland is a functional organ, disturbances of the metabolism of which are the principal factors in both acromegaly and giantism, the differences between the results being due to the stage of individual development at which the disturbance of function begins. Woods Hutchinson (N. Y. Med. Jour., July 21 and 28, 1900).

Therapeutics.—In acromegaly it cannot be said to have done much more than

to relieve some of the active symptoms and to have contributed to the patient's comfort. This means considerable in these cases, which sometimes suffer greatly from neuralgic pains, violent headaches, etc.

Statistics of 13 cases of acromegaly treated with pituitary preparations: In 7 cases varying degrees of improvement were noted. In 1 of these the improvement occurred under the combined use of pituitary and thyroid preparations. In 5 cases no effect was obtained; and in 1 case the patient was made worse by the treatment. F. P. Kinnicutt (Amer. Jour. Med. Sciences, July, '97).

Administration of the tablets for months at a time having failed to ameliorate the symptoms of acromegaly in personal cases, and the fact that extirpation of the pituitary gland in dogs and in man (when the hypophysis cerebri has been the seat of a destructive process, such as sarcoma) is not followed by any of the pathognomonic symptoms of acromegaly, would seem to prove that acromegaly is not due to obliteration of the glandular structure of the hypophysis, and that this alleged remedy has been used only empirically and is absolutely inefficacious. W. M. Leszynsky (Med. Record, June 30, 1900).

Organic Extracts.

Preparations of the various organs, the spleen, the ovaries, bone-marrow, the testicles, the brain and nerves, the kidneys, the lungs, the liver, and the pancreas have all been tried as remedial agents; but it may be said that, while only the products of the first five have attracted wide-spread attention, those of the spleen and ovaries alone seem to present sufficient value over other means at our disposal to still merit the confidence of the profession.

The preparations of the first five organs mentioned in the list will be reviewed in this article. During the last three or four years the use of even these five has been practically discarded.

Splenic Extract.

The use of spleen was suggested mainly by the fact that enlargement of that organ occurs in some cases of cretinism and myxœdema and after removal of the thyroid gland. This was further substantiated by the experiments of Oliver and Schäfer, who obtained a fall of arterial pressure followed by a gradual, but steady, rise, by means of intravenous injections of splenic extract, thus demonstrating that it was not inert. Krüger found that it increased the excretion of uric acid and of the xanthin bases.

Effect of spleen substance administered to a number of patients in the Lanark County Asylum, Hartwood, investigated for a period of two years. It was found to aid digestion and nutrition, to increase the cutaneous circulation, to stimulate the glandular activity of the skin, and in some cases to produce a favorable change in the mental condition. A. C. Clark (Edinburgh Med. Jour., Feb., '98).

Results of investigation of therapeutic value of spleen extract. Treatment was begun with three capsules of desiccated spleen representing 100 grains each of fresh spleen; this was increased to 6 capsules a week later. Capsules of liquid extract, each containing 20 grains of fresh spleen, were tried some weeks later, and with more distinct benefit. Conclusions are:—

1. That the most general result of this treatment is physical improvement.

2. That its action on the mental state is undoubtedly evident in a fair proportion of cases, especially of adolescents, sometimes direct, at other times owing to improved physical conditions.

3. That it materially assists in rendering thyroid treatment efficacious, the patient, after a course of spleen treatment, being more susceptible to the action of thyroid.

4. That where it fails there may be a defect in the preparation of the extract. We have found that capsules of the liquid extract are best. They have been made for us by Duncan, Flockhart & Co. The desiccated spleen, which is usually

employed for tablets, must necessarily lose some of its active properties.

5. It is best given at least half an hour before meals. Charles A. Bois and Neil T. Kerr (Brit. Med. Jour., Sept. 10, '98).

Administration. — Two practical difficulties are met with in administering splenic extract: it produces gastric pain and derangement of the digestion when given by mouth, and great local irritation and even abscesses when administered hypodermically, although, of course, this does not always follow. A splenic extract employed by Cohnstein is known by the trade-name of "eurythrol." It is a watery extract to which salt has been added, partly to preserve it and partly to give it a better flavor. It is described as resembling Liebig's beef-extract. The amount to be given daily is from 1 to 2 teaspoonfuls, dissolved in hot water. It does not seem to occasion distress.

Exophthalmic Goitre.—H. C. Wood observed three cases in which spleen extract produced very satisfactory results. One was cured and the other two were greatly improved. The advisability of trying this remedy is thus greatly emphasized.

Case of severe chronic exophthalmic goitre treated some years ago, in which an acute splenitis developed in a manner which was altogether inexplicable; no cause for the attack could be made out. Deep in the parenchyma of the organ there was formed an abscess whose opening and discharge were, after many months of severe sepsis and desperate illness, followed by return to health. In the second or third week of the splenitis the enlarged thyroid began to diminish, and in a short time regained the normal size. The result was a permanent cure of the exophthalmic goitre, no symptoms of the disease returning.

In a private case the disease was of six years' duration; the exophthalmos was very pronounced; the action of the heart extremely rapid and irregular: about 180. The enlargement of the thyroid was very great. The breathlessness was marked, and the general nervous erethism such that the patient was on the verge of insanity. A teaspoonful of the glycerin extract of spleen produced at once violent gastric distress, with local pain, lasting for some hours, and complete disgust for food. Other doses gave similar results. Following this, 10 minims were injected twice a day hypodermically into different portions of the body; they produced much local pain and hardening of tissue, but no abscess. This was kept up for six months, when 10 drops of the spleen extract with 10 drops of digitalis were administered three times a day. The improvement began not a great while after the commencement, and gradually increased. Before the treatment there was extreme breathlessness; now she walks comfortably for a long distance. H. C. Wood (Amer. Jour. Med. Sciences, May, '97).

Blood Disorders. — The physiological functions of the spleen promptly suggested the use of spleen extract in diseases of the blood, and encouraging results were obtained by Danilewski and Cohnstein. The former had found that the use of a watery extract of the ox's spleen, whether given by the mouth or subcutaneously, gave rise to a notable increase in the number of the red blood-corpuscles in dogs and rabbits.

Case of leukæmia treated by injections of splenic extract. There was very little pain, but copious sweating and fear, with which dyspnœa was sometimes associated. The effect on the blood was a decided increase of the number of leucocytes immediately after the injection, followed later by an increase, not sufficient, however, to restore the number to that previously present. This result is not interpreted as an evidence of real improvement in the disease, but rather as an apparent change due to retention of the leucocytes in the capillaries of the lungs. Paul Jacob (Deutsche med. Woch., Aug. 9, '94).

Statistics of twenty-three cases in which a watery extract (eurythrol) was employed. In one case the disease was

leukæmia; the others were examples of anæmia or chlorosis. In the case of leukæmia there was only a transitory effect observed, not really therapeutical. On the other hand, in the majority of the cases of anæmia and chlorosis the action of the extract was very striking. The first signs of improvement were seen in the subjective symptoms of debility, loss of appetite, constipation, headache, and dysmenorrhœa. Objectively, the pallor disappeared, and often there was an increase of the hæmoglobin or of the number of the red blood-corpuscles. In many cases the patients gained flesh notably. In many others there were no objective signs of improvement. In no instance was any unpleasant effect observed. W. Cohnstein (Allgem. med. Central-Zeit., No. 43, '96).

Extract of the spleen, by producing a decided leucocytosis, has a most gratifying effect upon the course of typhoid fever. In doses of 5 grains, three times a day, it rapidly and steadily reduces the temperature, ameliorates all the symptoms, and quickly restores the patient to the normal condition. To obtain the best effects from this remedy, however, the percentage of hæmoglobin and the number of red corpuscles muse be kept up to normal. Carpenter (Med. Record, Feb. 17, 1900).

Ovarian Extract.

Four well-known facts are given by Muret as fundamental reasons for the use of ovarian extract as a remedy,—namely, that (1) without ovaries there is no uterine development or menstruation; (2) ablation of ovaries in young children causes them to grow up without any feminine attributes: (3) after puberty loss of ovaries entails cessation of menstruation and atrophy of genital organs; (4) osteomalacia is cured by oöphorectomy,—all generally explained by some indefinite action of the nervous system. But the active principle giving rise to these effects is not defined.

The following statements may be formulated in regard to the use of ovarian extract:—

1. The ovaries, in common with other glandular organs in the body, exert an occult, but very positive, influence upon the general organism.

2. When this influence is removed, either by the natural atrophy of the glands at the climacteric, by destruction of the ovarian stroma from pathological processes, or by extirpation of the organs, there results a series of distressing phenomena, including hot and cold spells, nervous and mental manifestations, and neuralgic attacks.

3. The administration of ovarian substance or of the extract of ovarian tissue is promptly and very generally followed by a marked amelioration of these symptoms.

4. The average dose required varies from 2 to 5 grains of the extract administered thrice daily.

5. Excessive doses of the remedy will be followed by cardiac and nervous manifestations, necessitating a diminution in the dose administered or a complete, though temporary, change of treatment.

6. In some cases there appears to be developed a tolerance to the remedy whereby its effects are diminished in intensity. For this reason it is better to begin with small doses and gradually increase the amount given. W. A. Newman Dorland (Ther. Gaz., Apr. 15, '99).

Preparations and Dose. — The therapeutic uses of ovarian substance were studied by Touvenaint. Heifers' ovaries can be reduced to powder by desiccation at a temperature of 25° C. Pills containing $1\,^3/_4$ grains of the dry powder can be used, corresponding to 12 grains of fresh ovary. Three of these may be taken daily a quarter of an hour before meals. The average dose of dried ovary powder should not exceed 4 to 5 grains daily.

Liquid ovarian extract is another form: a glycerin extract of ovaries of young cows, containing 15 grains of ovarian tissue in $7\,^1/_2$ minims of glycerin, which is injected into the buttocks daily in doses of 7 to 15 minims.

Compressed tabloids, containing 4 to 5 grains of dried gland, proved quite as efficacious as the injections, when two or three a day were given, and were finally used in place of the injections. The treatment can be continued for a month or more and is always well borne. (Muret.)

Therapeutics. — In disturbances following removal of the ovaries or uterus, or in the nervous phenomena attending the menopause, ovarian tissue has given considerable relief. Lissac first tried crude ovarian tissue and ovarin by the mouth, and hypodermic injections of ovarian liquid; but ovarin was found to be most convenient, though it sometimes caused indigestion. The insomnia from which the patients all suffered was promptly relieved; cephalalgia generally disappeared and many psychical symptoms, mental depression especially, were ameliorated. In four of his cases uterine hæmorrhages ceased under treatment. The treatment should be continuous, however, if the relief is to be maintained. He mentions sixteen cases treated by Jayle in the same manner in which the flushing was more or less relieved, but returned after cessation of the treatment.

In exaggerated symptoms of the natural or induced menopause the ovarian treatment may be applied in two ways: (1) through transplantation of ovarian tissue, and (2) administration by the mouth. In case of induced menopause through hysterectomy no effect was obtained; but, of cases presenting severe symptoms during the natural menopause, three very much improved. Chrobak (Centralb. f. Gyn., No. 20, '95).

Tablets of 3 1/2 grains (Merck) of the entire ovarian substances, of the precipitate of the follicle-contents, or of cortical substance of the ovary of the cow, used in eleven patients, where either part or all of the internal genital organs had been removed; or where the patient complained of symptoms of the natural menopause: amenorrhœa, the result of atrophy of the genitalia, etc. The results were, as a rule, very encouraging, the symptoms being very much relieved. Mond (Münchener med. Woch., No. 14, '96).

Ovarian substance used in patients who had reached the climacteric age, who complained principally of sensations of fullness in the head, occurring many times during the day, pains in the back and legs, etc. The dose varied from 15 to 22 grains, administered in tablets containing each 7 1/2 grains of the ovaries of sows or cows. The sensations of fullness in the head had practically disappeared in two weeks. To avoid the influence of suggestion tablets containing none of the substance were given from time to time, but the symptoms immediately reappeared and the patients felt worse. The effect lasted only while the ovarian substance was being taken. Landau and Mainzer (Lancet, July 4, '96).

Ovarian extract tried in 21 cases, 9 nervous disorder due to menopause and of usual vasomotor origin, insomnia, lumbar pain, visceral troubles, flatulence, anorexia, etc. All cured or much improved. Three cases of climacteric irregularity of menstruation: 2 were cured and 1 improved. Muret (Rev. Méd. de la Suisse Rom., July 20, '96).

Ovarian extract appears to be particularly indicated in amenorrhœa and chloranæmia, in which the results are excellent. It is very useful in all cases of artificial menopause due to removal of the genital apparatus. It can also be tried with advantage for the removal of symptoms due to natural menopause. Touvenaint (Méd. Mod., Oct. 17, '96).

Results obtained from the use of ovary-juice in various diseases of women, especially those peculiar to the menopause. In 51 cases, 34 of which were personal, the results warrant the following conclusions: 1. The troublesome symptoms of the natural menopause disappeared or were greatly diminished by the use of the ovarian extract without any other medication. 2. Similar effects were produced by the administration of

that substance in the relief of symptoms —for instance, irritability of the bladder — that follow surgical operations which have for their result the suppression of the menstrual flow. 3. Rapid improvement is constantly seen in chlorosis and dysmenorrhœa. 4. The influence of extract of ovary on the psychical disturbances which accompany or are dependent on genital lesions are undeniable. 5. Rapid and permanent improvement in the general state. 6. Climacteric metrorrhagia without neoplastic lesions yield rapidly to the administration of the remedy. 7. Its therapeutic action on the nervous system is manifest from the first day of its administration. Author states that he will shortly publish the results of laboratory researches as to the chemical constitution of the substance which he prescribes. C. Jacobs (La Policlinique, Dec. 1, '96).

Ovarian extracts act directly for the relief of the disturbances attending the menopause, either natural or artificial. Its use is also valuable in amenorrhœa, dysmenorrhœa, and in anæmia of ovarian origin. Good results have also been noted in some cases of simple oöphoritis. Jayle (Revue de Gynéc. et de Chir., No. 4, '98).

Oöphorin preparations given to women suffering from acne rosacea and cutaneous disorders at the menopause, with satisfactory results. E. Saalfeld (Berliner klin. Woch., No. 13, '98).

Extract of corpora lutea, to which the value of ovarian extract is due, administered to patients suffering with the subjective phenomena commonly following the menopause, thought to be due to ovarian insufficiency. In two cases in which this substance was used, the same results as those obtained from the ovarian extract were noted. A. Lebreton (Lancet, July 15, '99).

The nervous disorders following removal of the ovaries or uterus were also found to be relieved by Landau and Mainzer, but only temporarily.

Knauer has shown that in rabbits the ovaries can be removed and then transplanted in other than their normal position. They can be attached to the peritoneum as well as implanted between muscle-fibres. Thus implanted, the ovary is nourished and continues its function. Might this not be repeated in the human subject to antagonize the symptoms following oöphorectomy or castration for hypertrophied prostate?

Case in which bilateral oöphorectomy was followed by flashes of heat, profuse sweating, headache, and marked sensations of pressure in the occipital region preceding and during the early part of the menstrual period. Three-fourths to 5 drachms of ovarian substance administered twice a day caused the attacks of flashes of heat and sweating to become less frequent and severe. This was followed by general improvement. Stachow (Monat. f. Geburtschulfe u. Gyn., B. 4, H. 1).

In disorders of any kind resulting from uterine affections, it seems to merit further trial.

Four cases of chlorosis treated for fourteen days with rest in bed alone, then a second period of fourteen days with ovarian extract. A relatively larger increase of hæmoglobin in the second series, and in three of these a larger increase in weight. The menses appeared in two after an absence of some months. Muret (Rev. Méd. de la Suisse Rom., July 20, '96).

Ovarian extract is harmful to chlorotics because the influence of the ovary upon the organism is of a chemical nature. The only form of opotherapy which offers any prospect of success in chlorosis is the medullary. U. Arcangell (La Riforma Medica, No. 91, '99).

Bone-marrow.

On the assumption that the red blood-corpuscles were produced mainly from the red bone-marrow, J. Dixon Mann, of Manchester, utilized an extract of this substance in anæmia and other conditions dependent upon a depraved condition of the blood. The cases have been numerous in which the results have ap-

parently supported Dixon Mann's hypothesis, great and rapid proliferation of the red corpuscles having been noted.

> Case of pernicious anæmia in which bone-marrow was employed in considerable success. Hæmocytes, 1,860,000 to 1,460,000 per cubic millimetre; hæmoglobin, 28 to 30 per cent. Three ounces of uncooked bone-marrow from the ox given by the mouth daily. After twenty-seven days the hæmocytes numbered 3,900,000 per cubic millimetre and the hæmoglobin amounted to 78 per cent. Fraser (Brit. Med. Jour., No. 1744, '94).

The tissue-forming power of young animals being taken as a criterion, the marrow obtained from them was thought to be preferable to that of older animals. The best results were obtained from the marrow contained in the ribs of a young animal. The coarse marrow from the long bones contains a great deal of fat, which does not contain the specific virtues to the same extent as the finer medullary substance.

Preparation. — The method of preparation advocated by the majority of writers is that recommended by Danforth, of Chicago. The anterior extremities of calves' ribs are comminuted so as to expose the cancellated tissue, and the fragments are placed in a jar and covered with glycerin, to the influence of which they are exposed for three or four days, being occasionally agitated. At the end of this time the liquid is strained, and the resulting fluid presents a reddish, syrupy appearance, without pronounced odor, and with the taste of glycerin. At first a teaspoonful of this extract is administered thrice daily.

The marrow may also be administered raw, on bread; but this method is usually repulsive to the patient.

Physiological Action. — An indirect influence as to the action of bone-marrow may be obtained from recently-made experiments by Trambusti, which have shown that bone-marrow reacts in the course of an infective diphtheritic process in rabbits with great functional activity of the cellular elements of which it is composed. This energetic functional activity of the cellular elements tends more toward the function of secretion than to that of reproduction. The increased function of secretion shows itself microscopically both by a greater quantity of granulations in the interior of the cell-plasma, and by a greater quantity of free granulations. The great functional activity of the cellular elements is diminished, with the progress of the infection, by the accumulation of a greater quantity of toxic material within the organism. Although this material in small dose stimulates the above-mentioned energy, yet it here acts as a paralyzant and in producing necrosis. The results which he has obtained from the use of bone-marrow justify the belief that the leucocytes produce a substance which is bactericidal and antitoxic. Its effects have been ascribed in the presence of iron.

> Whether or not it is anything more than an assimilable preparation of iron is not conclusively proved. Bone-marrow, especially red marrow, is certainly a readily assimilated, organic compound of iron, and is a valuable addition to the resources of the physician in cases of ordinary chlorosis and anæmia and in some cases of blood impoverishment of a more intractable kind. W. E. Quine (Boston Med. and Surg. Jour., Aug. 6, '96).
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> Any action bone-marrow may have must be due to some ingredient which stimulates blood-formation, and not to iron, or to any other constituent which might be directly used to build up red blood-corpuscles. Stengel (Ther. Gaz., '96).

Therapeutics.—Not much can be said in favor of bone-marrow as a therapeu-

tic agent. In pernicious anæmia it in no way approaches arsenic in value; in anæmia indications would seem to show that it is not as reliable as iron. In leucocythæmia, leukæmia, and Hodgkin's disease it seems worthy of more extended trial.

Pernicious Anæmia.—It is very doubtful whether bone-marrow can in any way be compared to arsenic as a remedial agent in pernicious anæmia. The belief that the active agent of marrow is iron would sustain this view, iron being as useless in true pernicious anæmia as it is useful in the benign form. There is ground for the suspicion that an erroneous diagnosis led to some of the favorable reports published. These are not included in this review.

Again, in the majority of the cases of pernicious anæmia treated with bone-marrow hitherto reported, their value as therapeutic records is much diminished by the fact that other drugs were often given in addition, and also that in no case has the further history and ultimate fate of the patient been recorded. It is well known that such cases often improve for a time under various forms of treatment, but they tend always to relapse, and ultimately to die.

Case of pernicious anæmia in a man, aged 60, treated with iron, arsenic, and salol, who made no progress until 3 ounces of ox-marrow were given in addition. Complete recovery followed. Fraser (Brit. Med. Jour., vol. i, p. 1172, '94).

Bone-marrow given in one case of pernicious anæmia, without benefit; in a second, however, occurring in a man aged 43, who had become worse under arsenic and to whom 3 ounces of fresh marrow were then given daily, the results were remarkable. In two months the blood-condition had returned to the normal in every respect. Barr (Brit. Med. Jour., vol. i, p. 358, '95).

Three cases of pernicious anæmia in which the red marrow did not have the least effect. In one of the cases rapid improvement was noted as soon as the patient was placed on arsenic. Bone-marrow should not be given unless arsenic has failed. G. B. Hunt (Lancet, Feb., '96).

Case in which marked improvement was brought about by bone-marrow and in which benefit had persisted up to the date of the report. Janeway (Ther. Gaz., May 16, '96).

Two cases of pernicious anæmia treated with bone-marrow. The first, a man aged 39, had various ups and downs, but ultimately succumbed. The second case occurred in a woman aged 60; but under similar treatment she also progressively sank. Stengel (Ther. Gaz., '96).

The most that can be said for bone-marrow in pernicious anæmia is that it should be tried where arsenic fails.

Anæmia and Chlorosis. — In severe anæmia, whether primary or secondary, bone-marrow has given better results than in pernicious anæmia. Here it would find a logical application, especially if, as thought by Quine, it represents an assimilable preparation of iron. The marked increase of hæmoglobin and the general improvement noted, especially in Mann's cases, would seem to warrant further trial of the remedy.

Trial in two cases of anæmia and two of chlorosis; doubtful whether the bone-marrow treatment is superior to iron. J. S. Billings, Jr. (Johns Hopkins Hosp. Bull., vol. v, No. 43).

Administration of the medullary glyceride has shown better results than that of iron or arsenic. Danforth (Amer. Med.-Surg. Bull., May 16, '96).

Twenty-two insane male cases of anæmia treated with bone-marrow. The average increase in red corpuscles was 1,361,489. The percentage of hæmoglobin increased on an average of 12.5 per cent. The leucocytes, which in nearly all were abnormal at first, decreased in number at the end of the month. The whole general appearance in the majority of the

cases improved. Appetite was better and the action of the bowels more regular. Mentally, one case began to improve at once and soon went home recovered. Three were regarded as much improved and four others were brighter and had lost a great deal of the apathy they formerly had. In the remaining fourteen the only improvement noticed was in their physical condition. Best results obtained with an extract made at the hospital by finely-chopped ribs of sheep and adding glycerin in the proportion of one pound to twelve ribs. This was permitted to macerate four days. It was then strained through gauze and was ready for use. W. O. Mann (Amer. Jour. of Insanity, Jan., '97).

Ten cases of anæmia and chlorosis treated by a preparation of nucleo-albumin and bone-marrow, shown in the table. D. D. Klots (N. Y. Med. Jour., Oct. 30, '97).

Case No.	Disease.	Percentage of Hæmoglobin at Beginning of Treatment.	Percentage of Hæmoglobin at End of Four Weeks.	No. Red Blood-cells at Beginning of Treatment.	No. Red Blood-cells at End of Four Weeks.	Weight at Beginning of Treatm't.	Weight at End of Four Weeks.
1	Chlorosis	54½	74	2,730,000	4,210,000	117	124
2	Chlorosis	43	68½	2,140,000	4,020,000	108	115
3	Chlorosis	51	75	2,340,000	4,120,000	93	99
4	Chlorosis	34	61	2,310,000	3,990,000	104	113
5	Chlorosis	44	74	2,360,000	4,030,000	117	123
6	Secondary anæmia	36	71	2,140,000	4,430,000	123	131
7	Secondary anæmia	51	62	2,420,000	3,320,000	133	136½
8	Secondary anæmia	54	65½	2,430,000	3,470,000	111	117
9	Secondary anæmia	42	63	2,170,000	3,940,000	141	149
10	Secondary anæmia	68	79	3,620,000	4,100,000	122	129

1. Subcutaneous injections of bone-marrow have no action on the red corpuscles or hæmoglobin of a healthy animal. 2. When the red corpuscles and hæmoglobin fall below their normal limits, injections of bone-marrow produce a decided rise in both. This rise is well marked, sudden, and of short duration. 3. Along with the increase in the red corpuscles there is no corresponding improvement in the form of the cells. 4. The active principle is present in an aqueous, but not in an alcoholic, extract of marrow; it is not precipitated by boiling; it does not contain iron, and may possibly be a deuteroproteose. Fowler (Scottish Med. and Surg. Jour., Sept., '99).

Malarial Cachexia. — In malarial cachexia bone-marrow has been tried, but, doubtless, what beneficial influence may have been obtained was due to the improvement in the condition of the blood.

Bone-marrow successful in two cases of malarial cachexia. All modes of treatment had failed. The remedy given in daily doses of 1½ to 3 ounces, either raw or in sandwiches. T. K. Alexeiew (Rev. Gén. de Clin. et de Thér. Jour. des Praticiens, Nov. 16, '95).

Four cases of malarial cachexia treated with the spleen and bone-marrow of cattle, with apparently favorable results. Gritzmann (Allg. Wiener med.-Zeit., June 30, '96).

Leucocythæmia and Leukæmia. — Extracts of the bone-marrow and of the spleen have been employed in the treatment of leucocythæmia, but so far there has been no great success, and the reason of the failure is obvious when we remember that in leucocythæmia the bone-marrow is hypertrophied, not atrophied. It is not probable that glycerin extracts of

marrow will prove valuable, since there is already too much marrow-activity. (H. C. Wood.)

Excellent results from the treatment of a case of leukæmia, in a lad of 12, with bone-marrow taken raw and spread on bread. After a few days the method was not particularly disagreeable. The improvement little short of marvelous. Rigger (London Lancet, Sept. 22, '94).

Good effects apparent within a few days. A. McLane Hamilton (N. Y. Med. Jour., Jan. 12, '95).

Case of splenic myelogenous leukæmia in which bone-marrow did not prove curative. Arsenic had also been used, but its physiological effects caused it to be stopped. Beneficial effects of marrow shown, however, by reduction of spleen and blood-count. C. E. Nammack (N. Y. Med. Rec., Dec. 14, '95).

Case of leucocythæmia in which, during seventeen days' treatment under arsenic (2 to 12 minims, t. i. d., liq. potass. arsenit.), no improvement occurred. A dessertspoonful of ox's bone-marrow spread on toast being given three times a day with arsenic, a remarkable diminution in the number of leucocytes followed, and continued after the arsenic was stopped. At the end of eight weeks the erythrocytes numbered 4,170,000, the leucocytes 25,000 (1 to 167). The patient left the hospital and subsequently ceased taking the marrow. At the end of six months she returned with the spleen larger than ever; the erythrocytes numbering 3,670,000; leucocytes, 225,000. Again given the tabloids of bone-marrow and began to improve at once. Four weeks later the patient became very ill, breathless, pulse rapid, temperature 102° F., pulmonary congestion and pleurisy, œdema of face and upper and lower extremities. The patient died a week later. At the autopsy there was a typical leucocythæmic spleen. Whait (Brit. Med. Jour., Apr. 4, '96).

Hodgkin's Disease. — Recent observations tend to show that bone-marrow may become a valuable remedy in certain forms of Hodgkin's disease.

Case of Hodgkin's disease at first placed on one fresh sheep's thyroid daily. Tiring of them, the patient was placed upon extract of bone-marrow and thyroid. From this time on there was rapid amelioration in all of the symptoms. The cough and night-sweats ceased and the glands rapidly diminished in size. Six months later she reported herself as feeling quite as well as she did before her illness. The enlargement of the glands had all disappeared. M. B. Herman (Memphis Med. Monthly, Feb., '96).

Well-marked case of Hodgkin's disease, erratic temperature, varying from normal to 102.5° F. Patient put upon the usual arsenic treatment, beginning with 2 minims thrice daily, and gradually increasing the dose until she was taking 7 minims three times a day of Fowler's solution, but in spite of this she steadily and rapidly got worse, till at the end of five weeks she was a perfect skeleton, profoundly anæmic, sleepless, and the group of glands affected so agglutinated that outlines of single glands were quite obliterated. The spleen was enlarged, temperature was almost constantly about 100° F., and her digestion failed completely. The case seemed rapidly moving toward a fatal termination.

Although bone-marrow tabloids had previously been tried in a case of the same disease in an adult without the smallest benefit, they were used in this case beginning with 1, thrice daily. The vomiting and diarrhœa soon ceased and the temperature was normal. This improvement steadily continued. The number of tabloids taken was gradually increased, till at the end of a fortnight she was taking 6 in the day. After two months she was apparently in good health, although the submaxillary and one of the cervical glands were still large. The tabloids were finally stopped. A fortnight afterward she was once more somewhat anæmic, and with the glands, which had subsided to normal, appreciably enlarged; tabloids resumed; she still continues to take 3 a day, and is now a plump, healthy child, but she still presents slight enlargement of the submaxillary and one cervical gland. J. D. L. Macalister (Brit. Med. Jour., Nov. 13, '97).

Osseous Deformities. — Although

affording but little information as to the actual value of marrow in disorders of bone, the following cases are nevertheless suggestive:—

Case of rheumatoid arthritis with symmetrical spindle-shaped joints and ulnar deviation. Under marrow, pain, creaking, and deformity were markedly reduced.

Case of rheumatic ankylosis of right wrist in a woman aged 43, flexion and supination being lost. Improvement.

Case of lateral curvature in a girl aged 17 1/2. The point gained was increased development of both sides of the chest, but much more on the weaker side.

Case of angular curvature in a girl aged 18. The curvature itself not reduced in size, but its irregularities have become smoother.

Extreme case of osteomalacia in a woman aged 44. The patient had not walked for twenty years. After bone-marrow treatment she could stand by holding to a chair, and could get from her bed into a chair unaided. T. M. Allison (Med. Press and Circ., Oct. 14, '96).

Orchitic, or Testicular, Extract.

As is well known, the removal of the testicles transforms the physical and mental attributes of an animal. Upon this is based the natural conclusion that these glands bear considerable influence upon general development and nutrition. With this undeniable fact before him, Brown-Séquard conducted investigations having for their object to determine whether the product could not be utilized as a therapeutic agent, and, after a series of experiments upon his own person, he ascertained that testicular fluid was capable of increasing mental and physical vigor. As to the curative influence on the various morbid conditions of the organism, he was of the opinion that, by injection under the skin, it could bring about the cure or considerable improvement of organic or non-organic affections of the most varied character, or, at least, cause their effects to disappear. These actions of the liquid were thought to be brought about in two ways: the nervous system, gaining in force, became capable of ameliorating the dynamic or organic state of the diseased parts, and, by the entrance into the blood of new material, new cells or other anatomical elements were formed, thus contributing to the cure of the morbid condition.

Unfortunately clinical evidence has not sustained the hopes of the distinguished physiologist, and the method introduced by him has, for the present, at least, practically fallen into disuse.

Testicular liquid was thought to possess such antiseptic properties that, if it should be contaminated by pathogenic germs, these germs would be rapidly killed or rendered powerless; but it was shown that the antiseptic properties were merely those possessed by any acid substance over certain micro-organisms.

Instances tending to show that the testicular fluid prepared at the Collège de France enjoyed certain antiseptic properties. It can retard for a month the putrefaction of a piece of meat placed in it. Brown-Séquard (Archives de Phys. Normale et Path., Oct., '93).

Testicular fluid always has an acid reaction, so that it is not surprising that it sterilized organisms which could live only in an alkaline medium. If microbes which could adapt themselves to a slightly-acid medium were chosen, such as the bacillus coli communis, the results were no longer the same. Sabrazès and Rivière (Jour. de Méd. de Bordeaux, Nov. 26, Dec. 3, '93).

Brown-Séquard's testicular fluid contains two substances which, when injected, are useful, and substances which have a disturbing action on the metabolism. Hirsch (St. Petersburger med. Woch., S. 51, No. 7, '97).

Preparation.—D'Arsonval and Brown-Séquard recommend the following

method: Take the testicles of a bull, divide each into four or five portions. Macerate for twenty-four hours in glycerin at 86° F., in the proportion of 1 quart per kilogramme of testicle. Add 5-per-cent. salt-water, $^1/_2$ litre to 1 kilogramme of glycerin. Mix and allow to macerate half an hour. Filter through Laurent paper No. 8, and sterilize the filtered liquid either by carbonic acid (sterilized filter, or an autoclave with carbonic acid without filtration through porcelain) or by filtration with aluminium without carbonic acid (a process inferior to the others, but simpler and within the reach of practitioners). The quantity of liquid from 1 kilogramme of testicle in the glycerin varies from 600 to 500 grammes. The quantity of glycerin is brought back by the addition of salt-water at about 15° Baumé. The liquid, in flasks containing 30 grammes, well corked and previously well washed in boiling water, keeps for several months without alteration.

This liquid must be injected under the skin, not pure, but one-half diluted with water recently boiled and cold. If the injection be painful, the liquid should be further diluted with water (10 to 40 drops). All vessels employed, as well as the syringe, cannula, skin of the patient, and fingers of operator should be carefully washed in 2-per-cent. carbolized water before and after injection. At least 2 grammes of the diluted fluid should be daily injected, and even 5, 6, or 8 grammes, diluted, or else 4 to 8 grammes should be injected in several places twice a week, preferably into the abdomen, between the shoulders, or into the buttocks. The treatment should be continued three weeks, and for some affections, such as myelitis and sclerosis of the cord, the time cannot be limited, but may be two or three months. Water should never be added to the liquid in the flask. The injections should be suspended if untoward effects are observed. The remedy may also be given per rectum, but diluted with water to avoid local irritation.

Another method of preparing a sterilized liquid is the following: The testicles are macerated in glycerin for twenty-four hours, and then filtered into a second apparatus through Chardin paper, which has been sterilized in carbon dioxide under a pressure of fifty atmospheres for three or four hours. It is not certain that the combined action of concentrated glycerin and carbon dioxide under a pressure of fifty atmospheres will result in perfect sterilization; therefore the use of extracts heavily charged with glycerin is persisted in. The new extracts are more active, as has been shown by experiment. The liquid should not be injected pure, but diluted with two or three times its volume of 1-per-cent. salt solution, or carbolized water, 1 per 1000. This solution should be made very slowly, so that an intimate mixture may be made. (D'Arsonval.)

Physiological Action. — Beyond the fact that it is capable of acting as a stimulant of vital energy and thus, perhaps, antagonize, to some extent, the debilitating influence of morbid processes, it is probable that suggestion plays the most important rôle in the results obtained. This, at least, is the opinion of the great majority of clinicians.

> In the great majority of cases the organic extracts act only by suggestion; sterilized water produced exactly the same effects as brain-substance, when injected in neurasthenia and hemiplegia. V. Negel (Bull. de la Soc. des Méd. et Nat. de Jassy, Nov. 1, '92).
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> If the injections were followed by the use of neutral glycerin an improvement took place. The same was the case in

patients treated only by injections of diluted glycerin or of phosphate of soda, as well as in those to whom the broiled organs were administered at meals. Is not this the best proof that the effects are due to suggestion? Guelpa (Le Bull. Méd., Apr. 16, '93).

Experiments with transfusion of nervous extract according to the methods of d'Arsonval and Constantin Paul, in ten patients in the asylum at Reggio. These patients were all of the curable class, and in no case was there recovery, and in only one any permanent improvement under the treatment. The greatest effects from its use are to be looked for in those cases where a physical element comes in play, and that its action is mainly through mental suggestion: an opinion vigorously sustained by Massalongo. C. Rossi (Rivista Sperimentale di Freniatria, etc., vol. xix, No. 4).

The method acts mainly by suggestion. The cases in which benefit had been obtained were rare and did not prove the antidotal virtue of the medication. Spermin is a vital principle scattered through the entire organism. The introduction of spermin into the system would be indicated when the elements of the economy contained it in smaller quantity than normal. Fürbringer (Deutsche med. Zeit., Mar. 15, '94).

[Suggestion plays a considerable rôle in this method, when the patients to whom it addresses itself are considered. Its author is wrong in exaggerating its value. It has been said to cure tabes, then cholera, then cancer of the stomach, not to mention a trifling disease like diabetes. Charcot, however, waited in vain for the cure of a single case of true ataxia in his service. How could it be otherwise where such organic lesions were concerned? That which is destroyed is lost, and all the organic liquids are of no avail. Besides, even the exact agent of these liquids is to such a point unknown that, according to some, it is the phosphate of soda and according to others phosphorus. The truth is that injections of organic liquids have generally a tonic effect, but here their ambition should end. Dujardin-Beaumetz and Dubief, Assoc. Eds., Annual, '94.]

In a series of experiments upon the action of orchitic extracts registered by means of a specially devised neuro-muscular apparatus, conclusion reached that capacity for work is increased by the action of such extracts, and in the fatigue as well a diminution in the subjective sensations of weariness. O. Zoth and F. Pregl (Pflüger's Archives, vol. lxii, p. 355).

The composition of orchitic extract of all animals found practically identical. The active principles consisted chiefly of two bodies: (1) nucleo-albumin and (2) spermin. The former was very toxic, producing great cardiac inhibition reflexly through the cardiac nerve-centres. The latter, spermin, which was also present in considerable quantity in semen, produced its effect principally by causing congestion of the abdominal viscera, including both the testes and ovaries. W. E. Dixon (Lancet, July 7, 1900).

Therapeutics. — In diseases of the nervous system—the stronghold of the method—the affection in which the greatest benefit was claimed was locomotor ataxia. In a series of thirty-nine cases, for instance, thirty-one were reported as either greatly benefited or completely cured. In much larger series the proportion of cures, etc., remained about the same; but, on the whole, the method has not in any way acquired the confidence of the profession, owing to the contradictory results obtained. In truth, Brown-Séquard himself did not pretend to do more than counteract the symptomatic manifestations of the disorder, and this the remedy certainly did for a time in a large number of cases. In epilepsy, however, it increased the severity and the number of paroxysms. In neurasthenia what benefit was obtained did not prove lasting.

Experiments in patients suffering from neurasthenia, hysteria, pulmonary tuberculosis, and locomotor ataxia. Testicular

juice has no physiological or therapeutic action upon the human organism; especially is there no action on the dynamometrical forces; it may have an irritating local action; whatever effects are observed, ephemeral and illusory, they should be attributed to the accidental variations of the disease, and principally to the action of suggestion. Magugliani (Gazzetta Med. di Pavia, May 1, '93).

In certain cases it is wrong to attribute the curative effects of the testicular liquid to suggestion. In certain animals the physical modifications observed in patients, such as slackening of the pulse, increase of muscular power, etc., have also been observed. The curative results are due to a special substance that gives to the nervous system a force which it lacks. As regards ataxia cured by this method, one must admit the disappearance of the symptoms, even if the lesion be not cured. Bouffé (Le Bull. Méd., June 4, '93).

As far as locomotor ataxia is concerned, testicular liquid acts by suggestion, and that this suggestive influence is all the more manifest because, for the most part, ataxic patients are doubly hysterical. The symptoms which are cured in these ataxics are precisely those dependent on hysteria. Bérillon (Le Bull. Méd., June 4, '93).

Twenty-eight cases of epilepsy treated by the subcutaneous injection of testicular fluid submitted to the treatment for a sufficient length of time to form a fair test of its value. In eight there was slight diminution of the fits. In the other twenty the fits increased. In none of them did the intellectual state show amelioration. Bourneville and Paul Cornet (Le Progrès Méd., Dec. 9, 16, '93).

Failure in a number of cases of ataxia, sclerosis, paralysis agitans, etc.; whatever temporary amelioration occurred attributed to mental suggestion. G. W. Wood and A. T. Whiting (London Lancet, Feb. 3, '94).

No improvement whatever in some cases of tabes dorsalis in which it was tried. Carter (Liverpool Medico-Chir. Jour., July, '94).

Orchitic extract used in a large number of cases. All cases of nervous disease, without organic lesions, which are benefited by bromide of potassium, will receive marked benefit from orchitic extract. H. Grey Edwards (Brit. Med. Jour., June 8, '95).

Forty cases, 30 males and 10 females, suffering from locomotor ataxia, sclerotic changes in the cord, neurasthenia, and the like, treated with from 20 to 30 minims average doses of Brown-Séquard's fluid, frequency of injections being every other day. Nausea, vomiting, and diarrhœa were caused by an overdose. Improvement was noted in nervous diseases of a chronic nature, and consisted in a general stimulation as well as an increase in the sexual sense. F. S. Pearce (Med. News, Aug. 22, '96).

Spermin has undoubted beneficial effect where other medication has failed. In the first case, after six injections, incontinence, bladder and rectal pains disappeared, and general tone and well-being improved considerably. After twelve injections had been given ptosis and oculomotor symptoms were cured. In the second case, one of paralysis agitans, the frequent insomnia, which in this patient seemed to be caused by auto-intoxication from gastro-intestinal disturbances, is usually relieved by a single injection of 1 cubic centimetre of spermin given hypodermically. M. A. H. Thelberg (Med. News, May 26, 1900).

Brain and Nerve Extract.

A number of observers, most prominent among which are W. A. Hammond, of New York; Constantin Paul, of Paris; and Dana, of New York, have employed extracts of brain-cortex and of nervous matter in various nervous diseases.

D'Arsonval prepared a glycerin extract made of sheep's brain and spinal cord, one part of these being emulsified with five parts of broth.

Dose. — Of d'Arsonval's glycerin extract 30 to 40 minims may be injected either into the abdominal wall or into the flank, the latter preferably, every day or every other day.

Physiological Action. — According to

Althaus, extracts of brain have a twofold action: they may be looked upon as a highly specialized pabulum of nervous matter, in consequence of their containing protagon, cerebrin, and lecithin; and, in the second place, they appear to act as antitoxins, as the phosphorized bodies split up, under the influence of the alkalinity of the blood, into glycerophosphoric acid and cholin, which have the power of stimulating intracellular oxidation and the elimination of leucomaines.

Brain and nerve extracts have also been credited with stimulating properties, manifesting themselves especially upon the heart and the general nervous system.

Therapeutics. — Hammond and Constantin Paul recorded a large number of cases of neurasthenia in which excellent results were obtained, and stray reports occasionally appear, tending to show that these extracts are occasionally used.

> Four cases of neurasthenia treated with subcutaneous injections of liquid extract of cerebral matter, 46 minims being injected three times weekly. In two cases marked improvement. Vetleser (Norsk Mag. for Læge., Mar., '95).
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> Brain emulsion in traumatic tetanus. Case in which an emulsion of the calf's brain with a physiological salt solution was used, 233 grains of brain-substance being injected in three doses, with aseptic precaution. Complete recovery occurred in eleven days, although abscesses at the points of injection appeared. A. Krokiewicz (Wiener klin. Woch., No. 34, '98).
>
> Case of a girl, 9 years old, in whom 240 grains of the rabbit's brain were employed without giving rise to abscesses, because the brain used was perfectly fresh, calf's brain having to come from a slaughter-house. Emulsion was also filtered through thick sterilized gauze. Schramm (Przeglad Lekarski, No. 3, '99).
>
> Effects similar to those obtained from the attenuated virus of Pasteur in the treatment of hydrophobia have followed the injection of brain emulsions obtained from normal animals, while functional nervous diseases, such as neurasthenia and epilepsy, have been favorably influenced. V. Babès (Klin. therap. Woch., June 17 and 24, 1900).

Babès and Gibier recorded cases of epilepsy which appeared to be greatly benefited, while Moncorvo found sheep's brain extract of value in various constitutional affections of childhood. Dana even reported a case of bulbar paralysis apparently cured by injections of gray matter, and Montagnon mentions a case of chorea also cured by this method.

On the other hand, the negative results reported have been numerous. These, added to the active commercial enterprise which has been connected with these agents from the start, have relegated them to the rear, and it may be said that the prevailing opinion, at present at least, is that they are therapeutically worthless.

Practically every organ of the body has recently been made to contribute an "extract," but it may be said that very few of these products have shown marked therapeutic value.

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ANOREXIA NERVOSA. — Nervous anorexia.

Definition. — Sympathetic or nervous anorexia may be defined as a manifestation of hysteria in which there is total absence of hunger, a distaste for food, and leading to voluntary starvation.

Symptoms. — Without apparent cause the patient expresses a repugnance for food, which gradually increases until all alimentation is persistently refused. In some cases the repugnance is so marked that tricks are resorted to by the patient to avoid swallowing any aliment that

may be introduced into the mouth by the attendants. Without showing any active manifestation indicative of a pathological process, the sufferer finally succumbs. This variety of anorexia is occasionally associated with melancholia. The number of respirations is usually reduced, and the temperature may be subnormal.

Case in a girl, aged 14 years, who showed no organic lesions. Respirations, 12 to 14; pulse, 46; temperature, 97° F. Cured by light food frequently administered. The patient showed a persistent wish to be constantly on the move, notwithstanding her extreme weakness. William Gull (London Lancet, Mar. 31, '88).

In marked cases the skin becomes dry, wrinkled, and cold, and the tongue is parched and sooty.

Etiology.—Hysteria is probably a factor in the majority of cases.

Case in a young girl in whom bromide of potassium caused recovery. It was learned that in the boarding-house in which the patient lived there was a girl affected with an hysterical disorder of the larynx, and that in a short time another young girl had become affected in the same manner as the patient. Schlesinger (Wien. med. Blät., No. 3, '88).

Careful inquiry usually shows that the patient belongs to a more or less neurotic family. The condition usually occurs in young girls, and occasionally in children.

Case of anorexia nervosa in a girl 7 ½ years old, who exhibited a morbid aversion to food, and who was reduced to a skeleton, with marked mental troubles; however, after some weeks of rational nursing and treatment she was restored to physical and mental health. Collins (London Lancet, Jan. 27, '94).

Pathology.—According to Sollier, the stomach is more sensitive than is generally supposed, and its sensitiveness has a large influence on normal digestion. The organ has motor and secretory functions, the latter depending on two factors: the condition of the glandular element and the nervous system. It is therefore evident that variations in the nervous system may affect the amount of secretion. The sensitiveness of the stomach is shown in three ways: by sensation of hunger, by contact of food, and by knowledge of satiety. In the anorexia of hysteria he has often found an area of cutaneous anæsthesia over the region of the stomach, which varies in intensity with the degree of altered sensation in the stomach itself; further, it is present only so long as the feeling of hunger is absent, and disappears when desire for food returns. It cannot be satisfactorily made out in the graver forms of hysteria, where cutaneous anæsthesia is extensive. If the mechanical functions are also involved there may be gastric atony.

Case of hysterical anorexia in which, while there was no evidence of visceral disease, and no sugar in the urine, the breath smelled of acetone, and the urine gave a most marked reaction of aceto-acetic acid. There was vomiting, and the vomit also contained acetone. In the first, or comparatively fasting, period, acetone, aceto-acetic acid, oxy-butyric acid, and ammonia were found. The amount of urine was small, and hence a considerable excretion of acetone occurred through the lungs. With sufficient nutrition the smell of acetone in the breath, the reaction with ferric chloride in the urine, and the increased ammonia excretion disappeared. Nebelthau (Centralb. f. inn. Med., Sept. 25, '97).

Diagnosis.—CANCER.—The fact that carcinoma of the stomach may be simulated by grave forms of hysteria seems scarcely possible, and yet cases are encountered in which, after long observation, the diagnosis is uncertain. Hysterical cases have even been met with in which, with all the subjective symptoms of gastric cancer, there has eventually appeared an apparently pathognomonic tumor, the growth being composed of

the patient's own hair which she had swallowed.

Gastric Ulcer.—Severe pain, nausea, and vomiting, which are occasionally observed in anorexia nervosa, may suggest gastric ulcer, but the other symptoms—the character of the pain and the time at which it occurs—will usually serve to clear the diagnosis.

Diabetes. — This condition may be suggested by the facies of a case, but the degree of wasting is far greater in anorexia, and the urine does not contain sugar.

Fatal case of anorexia nervosa in a girl aged sixteen years. (*Stephens.*)

Prognosis. — Anorexia nervosa but rarely proves fatal. When great debility is reached, manifested by a dry, wrinkled, cold skin; a small, rapid pulse; and a dry, sooty tongue, the likelihood is that death will ensue unless forcible means are utilized.

Two cases ending in death. The disease is rarely fatal of itself, death coming on through some other disease. Tuberculosis has been known to supervene in these cases. Nothing prepares the soil better for tuberculosis than anorexia. Debove (Le Progrès Méd., Oct. 19, '95).

Fatal case, in a girl of 16 years, simulating diabetes. Urine normal. Up to eleven months before death the patient was a fine healthy-looking girl. After death the body weighed but forty-nine pounds. The brain and other organs found normal. Lockhart Stephens (London Lancet, Jan. 5, '95).

Treatment. — Isolation, hypnotic suggestion, hydrotherapy, gastric electrization,—intra and extra,—gavage, and lavage of the stomach have all proved useful in some cases. But occasionally these means fail. In these cases Debove insists on the necessity of compelling the patient to eat, by whatever means, the appetite returning as the case improves.

Anorexia nervosa in a man, aged 25 years, whose weight was seventy pounds, in which compulsory feeding was employed. The patient, who had been in bed five years, gained fourteen pounds after a month's treatment. Drummond (London Lancet, Oct. 19, '95).

Hypodermic injections of morphine have been recommended, but the danger of producing morphinomania in such cases is very great. This method should, therefore, be used with the greatest of care, and only after all other means have failed.

Three cases successfully treated in the following manner, after all other means had failed: Morphine, about $^1/_2$ grain, was injected at four-hour intervals, until three doses had been given, or until there was paralysis of the stomach-wall (in two cases three doses accomplished this result). Each patient was told that she would become numb, that her pains would diminish, and that she would be able to take and retain the food that would be given to her a half-hour after the injection. The injection should be given at the same hour each day, and be followed in a half-hour by the administration of food, either with gavage or without gavage. The patient should also be assured that the food will be retained, and that it will not give rise to pain. After having used morphine in the manner indicated, these patients become hypnotizable and suggestionable in a few days. The diminution of the dose of

morphine should be made progressively as soon as alimentation and assimilation have been sufficient to augment the body-weight. S. Dubois (Le Progrès Méd., Feb. 22, '96).

Orexin tannate is the best remedy for simple anorexia or loss of appetite in children, on account of its easy administration. For adults 6 grains should be given one hour before each meal; for children the dose should be decreased according to age. When administered to convalescents it increases the appetite, and aids digestion and assimilation. In all cases—even of tuberculosis—the body-weight increases. T. W. P. Smithwick (Merck's Archives, No. 3, p. 88, 1900).

ANTHRAX.—Gr., ἄνθραξ, a coal.

Definition.—A malignant pustule due to infection by the bacillus anthracis, by which, from an infected centre, it may spread over the body or attack the intestinal tract, resulting in a general infection. It is also known as "wool-sorters' disease" in man and "splenic fever" in animals.

Seventy-two cases of anthrax met with in a factory near Paris where skins are tanned and wool prepared. Skins and fleeces coming from Turkey, Russia, Bulgaria, and Argentine are infectious. Of the 72 cases, 62 were cured, giving a death-rate of 14 per 100. Among the hands employed in treating skins there were 57 cases among 560, 15 among 160 workers engaged in preparing wool and tails. Prophylactic measures are of the greatest importance. M. le Roy des Barres (Brit. Med. Jour., Sept. 25, '97).

Report of seven cases of malignant pustule. The discoloration, œdema, necrosis, and pain were all characteristic. There was in all cases a suspicious history of anthrax, and in five cases a hair follicle was first affected. In four cases typical anthrax bacilli were cultivated, but in two cases the only microbes found were staphylococci. Holscher (Archiv f. klin. Chir., Bd. 69, H. 1 u. 2, 1903).

Symptoms.—The clinical diagnosis is not always easy. The most frequent primary lesion is in the face. The first symptom is a sense of itching, followed by a red spot resembling a flea-bite; a small vesicle forms soon afterward, containing a bluish fluid. The surrounding skin is somewhat indurated and swelled. This changes into a black spot, which soon becomes gangrenous. If the œdema continues fresh crops of vesicles often appear, undergoing the same change, and infecting the adjacent lymphatic glands. The period of incubation is from one to three days, while the development of the local symptoms occupies from three to nine days. A line of demarkation may then form, and the slough separates. No pus is present. General disturbance begins only a day or two after the manifestation of the disease. There may be no fever, but in some cases, especially when the face is involved, a sudden rise of temperature may present itself, denoting a dangerous condition.

Headache, nausea, and pain in the muscles appear, with a weak and rapid heart. There is slight icterus. The prostration is great, and the last stages of the disease finds the patient almost in the algid stage of cholera.

When infection takes place through the alimentary canal, the disease begins with debility, depression of spirits, malaise, and probably a chill. In addition the symptoms point to the intestines. Hæmorrhages occur from the mouth and nose; vomiting is followed by a bloody diarrhœa. The diagnosis is, however, extremely difficult, and the microscopical examination of the blood or an inoculation of an animal furnishes the only conclusive evidence.

Difference between effects of the localization of the pneumococcus and that of

the anthrax bacillus. In the former true encephalitic phenomena are produced; in the latter, only hæmorrhages. This is evidently ascribable to a difference in the metabolic products of the respective micro-organisms. E. Fraenkel (Zeit. f. Hyg. u. Infectionsk., B. 27, H. 3, '98).

Etiology. — Anthrax was one of the first diseases traced to a specific micro-organism.

Pollender discovered in 1849 small rod-shaped bodies in the blood of animals suffering from anthrax, but Davaine, in 1863, proved their etiological significance. Pasteur and Koch, observing that the bacilli bore spores, cultivated them successfully outside of the body, and then produced the disease by inoculating animals with the pure cultures.

The anthrax bacilli are large rods, with a rectangular form, caused by the very slight rounding of the corners. They measure 5 to 20 microns in length and are 1 to 1.25 microns in breadth. They form long threads, in which the single bacterium can be made out. At times isolated rods occur. In this stage granular bodies appear in the protoplasm of the bacilli. They eventually form glistening oval spores, one of which lies in each segment of the long thread, giving the threads an appearance of a string of beads. The bacilli soon break up, and the spores become free. In this condition the spores become highly resisting and can be preserved a very long time. If again placed under favorable circumstances each spore will germinate into a mature cell. Spore-formation takes place only at temperatures ranging from 18° to 43° C., 37.5° C. being the most favorable temperature.

The anthrax bacilli can rapidly be stained by aqueous solutions of aniline dyes, and also by Gram's method. The spores are best stained at a high temperature by means of Ehrlich's aniline-water-fuchsin solution or Ziehl's solution containing carbolic acid, instead of Ehrlich's fuchsin solution.

The virulence of anthrax bacilli can be attenuated in various ways, such as subjecting them to a high or low temperature or making the culture grow for a long time—twenty-four days or so—at a temperature of 42° or 43° C. By treating them in some such manner it is possible to render anthrax bacilli entirely innocuous (Koch, Loeffler). Pasteur rendered sheep and cattle immune against anthrax by inoculating them with a culture which grew at a temperature of 42° C.

Dogs, pigs, and the majority of birds are immune from anthrax; also rats and frogs under ordinary conditions. But if a frog in whose lymph-sac are placed anthrax bacilli is put in an incubating apparatus, he will quickly die of anthrax. Birch-Hirschfeld and others have proved that anthrax bacilli can be transmitted from mother to fœtus *in utero*.

Experiments to determine the influence of the serum of immunized animals. A sheep was immunized until it could bear the injection of 7 agar-agar cultures with but slight elevation of temperature. A lamb was immunized likewise to the highest degree and blood was taken from the carotid artery of both animals in order to obtain serum. With the serum of the sheep it was actually possible to save from death a rabbit in which an extremely virulent culture of anthrax was injected, either after or simultaneously with the serum. Evident therapeutic results were obtained with this serum in animals that had received the anthrax bacilli previous to the injection of serum.

The attenuated form of anthrax is not microscopically different from the viru-

lent form, but it is quicker in growth and more resistant. The more virulent the growth, the more acid it is, and, *vice versâ*, the more alkaline the blood-serum, the more difficult it becomes for the anthrax bacillus to grow. Behring (Zeit. f. Hygiene, Apr. 12, '89).

Experiments on rabbits and sheep to ascertain relative value of serum-therapeutics and vaccination. Intravenous injections of small doses of virus are not more severe than subcutaneous ones, but large quantities are far more lethal when given in the veins. A sheep vaccinated is refractory to a large dose of anthrax, but its serum has no curative power. When immunized to a very high degree, the curative power of the serum may become marked from two to three weeks after inoculation, after which its activity diminishes. By intensive inoculation of sheep a serum is obtainable, having distinct prophylactic properties. As to the curative properties of the serum, that obtained from rabbits was not found strong enough to avert death. The immunity produced by this serum is evanescent; that resulting from vaccination was, on the contrary, lasting. Marchoux (Annales de l'Institut Pasteur, Nov., '95).

No immunizing substances found in the blood either of animals treated with Pasteur's vaccine or of those who had passed through an attack of anthrax. In animals treated for weeks and months with increasing doses of virulent anthrax cultures so that an active immunity is acquired, such protective substances are present in the blood. The serum obtained from a sheep thus treated conveyed a certain degree of immunity when injected into rabbits. Attempts at cure of the disease in rabbits were without effect. In 2 out of 7 sheep in which 100 to 150 cubic centimetres normal serum from a lamb were first injected, then small quantity of a virulent anthrax culture, both animals succumbed. Three other animals were given a single dose (50, 100, and 200 cubic centimetres of serum) and later a virulent anthrax culture. All these animals recovered. The sixth and seventh animals were also injected with smaller virulent cultures and later with anthrax serum. Both recovered. Sobernheim (Berliner klin. Woch., Oct. 18, '97).

The sphalangi of Cyprus is an insect resembling an ant of medium size whose sting gives rise to anthrax. To this is ascribed the fact that anthrax is very common in Cyprus, especially among the animals, the bacillus being carried by the insect from the carcasses of such animals to human beings. G. A. Williamson (Brit. Med. Jour., Sept. 1, 1900).

Case in which the source of infection was bone-dust which the patient had handled. The patient died on the fourth day after his initial symptom. The temperature did not rise above 100° F. The lesion was situated on the breast, where he had scratched himself, and there was an entire absence of pain, severe constitutional disturbance, and feeling of distress. E. F. M. Neave (Lancet, Oct. 6, 1900).

The antibodies for the virus of the anthrax bacilli are to be found in the endothelium of the blood-vessels. The contact of the toxic agent of the living bacilli with the fixing material in the endothelium is probably brought about by the normal presence of a colloidal solution of the antibodies in the intravascular and the intracellular fluids. Von Behring and Much (Deutsche med. Wochen., Jan. 1, 1904).

Prognosis.—The prognosis of anthrax in man, when infection takes place externally, depends mainly upon whether energetic surgical treatment is undertaken early enough. Lengyel and Koranyi, by adopting suitable local treatment, lost only thirteen out of one hundred and forty-two cases. Patients with anthrax resulting from internal infection (intestinal, pulmonary) very rarely recover. (Tillmann.)

Of thirteen cases of anthrax under observation, five died, in all of which the primary lesion was on the lateral aspect of the neck. In remaining cases the initial lesion was situated on the forearm, cheek, forehead, occiput, and neck. The serious character of the lesion when it is situated in the neck ascribed to loose subcutaneous cellular tissue allowing ex-

tension of the infection. Radical surgical treatment apparently aggravated the progress. Sick (Centralb. f. Chir., Sept. 9, '99).

Prophylaxis. — The fact that French skins, since Pasteurian inoculation has been employed in French flocks, have been found to rarely cause anthrax speaks in favor of that method. Disinfection, even by formol, is uncertain.

Skins of French animals are never infectious, the result, it is believed, of anthrax being almost stamped out among the French flocks by the practice of Pasteurian inoculation. Formol-vapor does not penetrate them sufficiently to disinfect thoroughly. The only safeguard against anthrax infection is the Pasteurian inoculation. M. le Roy des Barres (Brit. Med. Jour., Sept. 25, '97).

The present laboratory-method of producing immunity to anthrax gives rise to a very transient immunity, and in order permanently to protect animals that are spontaneously exposed it is necessary to modify the method so as to deprive the immunity of its transitory character. By combining passive immunization (by means of serum) with active immunization a marked success observed. Sheep received mixtures of anthrax serum and attenuated anthrax cultures, and were still immune to virulent cultures one and one-half months afterward. A. G. Sobernheim (Berliner klin. Woch., Mar. 27, '99).

It is possible to extract from the anthrax bacillus, by chemical means, a substance which gives the same reaction as the nucleoproteid of bacteria. Small doses of this substance inoculated into rabbits are capable of conferring immunity to anthrax infection in the majority of cases; and in some cases the fatal issue is retarded in vaccinated animals who succumb to the infection. N. Tiberti (Policlinico, Jan. 3, 1903).

Treatment. — In man the disease remains localized a longer time than in animals. Hence it is possible to remove it more thoroughly. Complete extirpation of the affected part, by means of the Paquelin thermocautery, and subsequent cauterization with nitric acid are to be practiced.

According to Koch, bichloride of mercury is the most effective poison for the anthrax bacilli, being capable of killing them when used as diluted as 1 part to 300,000 of water. Consequently it is a good plan to use, in and around the affected part, injections of 1 to 100 bichloride or 2- to 5-per-cent. carbolic acid. General treatment has been very unsatisfactory, although Russian authors have met with success by the energetic use of carbolic acid locally and internally.

Absolutely unvarying success in treating malignant pustule by the method of the Spanish physician, de Sande. Five successive drops of a 4 per cent. solution of corrosive sublimate are placed on the pustule, one at a time, waiting for each to dry before the next is applied. One application is generally sufficient, the symptoms subsiding in from twelve to twenty-four hours. If not, the application may be repeated the next day. Castro (Siglo Medico; Merck's Archives, Aug., 1905).

The fact that experiments have shown that ipecacuanha added to tubes containing 5 cubic centimetres of broth invariably destroy the vitality of all the anthrax bacilli present, and no growth ensued (provided that they contained no spores) has suggested the use of this drug as a remedy.

Nucleinic acid has also given promising results in the hands of Vaughan.

In anthrax and other septic conditions general infection must be prevented, yet no operation is indicated. Applications to the carbuncle, with fixation and internal treatment, suffice. Operative interference may cause general infection; yet, when abscess forms, it should be thoroughly evacuated. A dry dressing is advised; in some cases iodoform gauze and pure carbolic acid are good. In all but very slight conditions moist dress-

ings are contra-indicated. E. Lexer (Die Therapie der Gegenwart, Jan., 1903).

Best results obtained from local application of a current of oxygen gas. This is accomplished, when the pustule has broken down, by directing, upon all parts of its surface, a current of oxygen from a cylinder containing the gas under a pressure of twenty atmospheres. This treatment is continued for fifteen minutes and is supplemented by injections of the gas into the surrounding tissues by means of a Pravaz needle attached to the end of the delivery tube, and compresses saturated with dilute peroxide of hydrogen. If the anthrax be seen in the stage of tumefaction before suppuration has set in, injections of the gas into the tumefied tissue and surrounding inflammatory areola, followed by a dressing saturated with peroxide, frequently suffice to abort the pustule. The Pravaz needle should be inserted at numerous points, and at each introduction the gas should be allowed to flow for about a half minute or until gaseous crepitation is felt, the tumor being thus isolated, as it were, in an atmosphere of oxygen. From one to two treatments usually suffice to effect a cure. G. Barnich (Jour. Méd. de Bruxelles, Sept. 24, 1903).

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ANTIPYRINE.—Phenazonum (Br. Ph.); antipyrinum (Ger. Ph.). Antipyrine is an alkaloidal product from the destructive distillation of coal-tar, discovered by Knorr. It is known chemically as dimethyl-oxy-quinizine of phenyl-dimethyl-pyrazole (organic base from oxyphenyl-methyl-pyrazole). It is known also as analgesine, methozine, parodyne, phenylone, and sedatine. It occurs as a fine, white, crystalline powder, and is soluble in chloroform, in an equal weight of water, in 2 parts of alcohol, and in 50 parts of ether. It melts at 105° to 113° C. (210° to 235.4° F.) according to dryness. It has antipyretic, analgesic, sedative, styptic, and antiseptic properties. The following substances incompatible with antipyrine are said to precipitate the drug from concentrated solutions: Carbolic acid in saturated solution, tannin (a white insoluble precipitate), mercuric chloride (white precipitate soluble in an excess of water), infusion and tincture of catechu; infusion, fluid extract, and tincture of cinchona-bark; infusion of rose-leaves, infusion of uva ursi, tincture of hamamelis, tincture of iodine (precipitate soluble in water), tincture of kino, tincture of rhubarb; solutions of chloral, arsenic, and mercury; and alkalies.

In the following mixtures antipyrine is decomposed: Calomel forms with antipyrine a toxic combination; antipyrine in decomposed when rubbed up with betanaphthol; with chloral, antipyrine forms an oleaginous liquid; with sodium bicarbonate it disengages the odor of ether; with equal parts of sodium salicylate it forms an oleaginous mixture.

The following substances produce coloration when added to aqueous solutions of antipyrine: Hydrocyanic acid: dilute solution—yellow; nitric acid: dilute solution—pale yellow; ammonia alum: dilute solution—dark yellow; amyl-nitrite: acid solution — green; nitrous ether: alcoholic solution — green; ferrous phosphate: yellow-brown; ferric sulphate: blood-red; ferric chloride: blood-red; syrup of iodide of iron: red-brown.

Dose.—The usual dose for adults is 15 grains in powder or dissolved in water, syrup, or elixir, every two to six hours, or four or five times daily. The maximum single dose for an adult is 20 grains. The maximum doses for children are: 6 months to 1 year, 3 grains; 1 to 3 years, 4 to 5 grains; 4 to 5 years, 4 $^1/_2$ to 6 grains; 6 to 8 years, 7 $^1/_2$ to 9 grains; 10

to 12 years, 9 to 10 1/2 grains. Generally, it will be found that small doses, repeated at intervals of two hours, are attended with therapeutic effects and with less danger of untoward symptoms than larger doses given at longer intervals.

Caution against the simultaneous use of antipyrine and calomel. Their reactions result in the formation of a dangerous amount of corrosive sublimate, even when ordinary medicinal doses are given. H. Werner (Pharm. Zeit., June 10, '96).

Antipyrine and sodium salicylate cannot be dispensed together in powder form; immediately, or within a short time, liquefaction takes place, and when the powders reach the patient he is likely to find no powder at all, but only thoroughly soaked pieces of paper. W. J. Robinson (N. Y. Med. Jour., Oct. 30, '97).

In giving the drug the personal idiosyncrasy of the patient should be considered, as well as the integrity of the urinary and cardiac functions. A dose which would be safe for a person with healthy heart and kidneys might cause dangerous symptoms in a case where these organs are diseased. (Lépine.)

Case of idiosyncrasy to antipyrine. Author suffered from migraine and used to be in the habit of taking 15 grains of antipyrine during the attacks. These were followed by the occurrence of small, aphthous ulcers on the mucous membrane of the lips, cheeks, and tongue, which healed very slowly. Another time his lower lip became swollen and œdematous, and in two hours an ulcer appeared on the tongue. Several others shortly afterward formed on the lips and cheeks, and took fourteen days to heal. In addition he suffered from dermatitis about the genital region. Another case of the same nature met with in practice. Intolerance of the same kind gradually developed in him to all drugs of the same class, — quinine, antifebrin, phenacetin, and sodium salicylate,—which he had used to check the migraine. Steinhardt (Ther. Monat., Nov., '93).

Case of a young man who had often taken antipyrine without discomfort until he was 17 years of age, when he suffered from typhoid fever, and developed marked intolerance to this drug. In the course of the following year he took it several times, once a dose of 15 grains, afterward half this dose, then only 3 or 4 grains, and finally between 1 and 2 grains. Even after the smallest dose unpleasant symptoms appeared. At first there were marked twitchings in the genital and anal regions. In a few days there appeared here numerous blebs, which burst and formed scabs. On the gums there appeared also little blisters. The remarkable fact in this case is that intolerance developed after typhoid fever. (Jour. de Méd. et de Chir., Dec. 25, '96.)

A review of cases in which dangerous symptoms or death had followed suggests that antipyrine should not be given in antipyretic doses to fever patients, because it interferes with the action of the kidneys, and that in febrile conditions complicated by nephritis (pneumonia, typhoid fever, tuberculosis, etc.) it is contra-indicated. It must be avoided in true angina pectoris, because it acts injuriously on the heart-muscle, and there is always danger of cardiac dilatation in this affection. In the neuralgic form of angina pectoris there is no reason for preferring its hypodermic use to that of morphine. Weakness of the circulation, too, is a contra-indication to antipyrine. (Eloy.)

Warning against its employment in all cases in which the kidneys are diseased, since its elimination is interfered with, and toxic effects might arise. Arteriosclerosis should not be treated by it, even when the kidneys are not affected. Huchard (Jour. Amer. Med. Assoc., July 7, '88).

Contra-indications for the employment of antipyrine: a weak heart; diphtheria, with phenomena of myocarditis; profuse hæmorrhages; in debilitated subjects; convalescence from chronic fevers; and the night-sweats of tuberculous patients.

B. Martin (L'Union Méd., Oct. 20, 22, 27, '91).

Persons suffering from erysipelas seem to be peculiarly susceptible to antipyrine. It usually causes anuria and a profound fall of temperature, requiring caffeine and hot applications. Erysipelas is one of the infectious diseases in which antipyrine is contra-indicated. Spanoudis (L'Abeille Méd., Mar. 27, '97).

Antipyrine intoxication after the ingestion of 15 grains in the form of migrainin. The symptoms were dryness in the mouth, painful redness and swelling of the fingers, vesicles on hard palate, salivation, purpuric eruption on legs, eczema of scrotum, œdema and vesicles of lower lips, œdema of prepuce, fever, and rapid pulse. G. Graul (Deut. med. Woch., Jan. 19, '99).

Three cases of a remarkable eruption caused by antipyrine. This eruption consists of dark blotches in the skin of the penis, sometimes accompanied by œdema. In one case the eruption appeared four and a half hours after the first dose was taken. The patients were alarmed, thinking that gangrene of the penis was going to follow. Fournier (Ann. de Derm. et de Syph., Apr., '99).

Physiological Action. — Antipyrine is excreted by the kidneys, and may be found unchanged in the urine. Perret and Givre have shown that, no matter what the age of the person may be, elimination by the urinary tract begins at the same time, varying from three-fourths of an hour to an hour. They found, however, that the elimination is finished sooner in the child than in the adult, and likewise in the adult than in old age. The conditions causing accumulation in the system do not influence in any manner the time of the appearance of antipyrine in the urine, but notably increases its duration. Any of the substances producing coloration when added to aqueous solutions may be used as a test to detect the presence of antipyrine in the urine, but ferric chloride is most generally employed for the purpose, detecting antipyrine in dilutions as high as 1 to 100,000.

The elimination of antipyrine when given by the rectum occurs from the mucous membrane of the stomach, in from one-fourth to one-half hour before taking place by the kidneys. P. Kandidoff (Wratsch, No. 13, '93).

Antipyrine appears in the urine forty minutes after its ingestion by the stomach and thirty minutes after its introduction by the rectum. Lamanski and Main (Le Bull. Méd., Jan. 29, '93).

Antipyrine may be excreted from the rectum, the mouth, or from the subcutaneous connective tissue when given by hypodermic injections.

When a medium dose (10 to 15 grains) is given, we notice a fall of temperature, from one to five or more degrees, at the time the temperature becomes very subnormal. This reduction of temperature is apparently not due to the diaphoresis induced, which is sometimes small in amount, but by its inhibitory action upon the heat-regulating centres in the nervous centres. This action is seen in health as well as in disease. With the reduction in temperature is noticed an increased action of the sweat-glands, perspiration being seen first about the forehead and neck, and later upon the chest and face. Chilly sensations, which may be experienced if the sweating is excessive, can be removed or prevented by the exhibition of stimulants: atropine or agaricin. Stimulants will also prevent the depressing action upon the heart.

With the calorimeter of d'Arsonval heat-dissipation found to be decreased, there being a corresponding diminution in the process of heat-production. Destrée (Jour. de Méd., de Chir., et de Pharm., July 20, '88).

The reduction of temperature produced by antipyrine is exclusively due to increase of heat-dissipation, while the phenomenon of heat-production remains

unaffected. Gottlieb (Arch. exper. Path. u. Pharm., vol. xxviii, H. 3, 4, '91).

Antipyrine produces a decided fall of temperature in the first hour after its administration in the fevered animal; this reduction is due to a great increase in heat-dissipation, together with a fall in the heat-production. Cerna and Carter (Notes on New Remedies, Sept., '92).

The pulse is generally reduced in frequency concurrently with the fall in temperature, but not in the same ratio, and sometimes not at all. The blood-pressure is usually increased with the fall of temperature, but is occasionally reduced by reason of a dilatation of the peripheral blood-vessels. The heart-beat is generally reduced and the force of the systole is lessened, at least to some extent, and in this lies the great danger attached to its use: a contrary effect to that produced by quinine, which sustains the heart.

In regard to the influence of the drug upon the secretion of urine, experiments have shown that the quantity is diminished in twenty-four hours; this is also the case as regards the amount of urea eliminated under its use.

Experiments apparently proving that the main action of the drug is upon the nervous system, not in its peripheral portions, but rather upon the spinal cord and brain. Batten and Bokenham (Brit. Med. Jour., June 1, '89).

Experiments sustaining Batten and Bokenham as to the effect of the drug upon the spinal cord, and in its local and general action as a sedative to the sensory nerves. Also in accord with most observers in the statement that antipyrine does not affect the circulation to any extent in moderate doses. Simon and Hoch (Johns Hopkins Hosp. Bull.; Apr., '90).

Antipyrine in doses of 30 grains causes an increase in the number of leucocytes in the blood and a decrease in the quantity of uric acid eliminated by the urine. J. Horbaczewski (Sitzungs b. d. K. K. Wiener Akademie der Wissen., p. 101, '92).

Antipyrine promptly causes marked vasoconstriction. The vasoconstriction, both of the arteries and veins, may be sufficiently marked to obstruct the circulation in, and cause engorgement of, the capillaries. Very large doses, small doses too frequently repeated, or small doses in subjects whose adrenal system is abnormally sensitive may cause sufficient vasoconstriction of the arteries and veins to greatly reduce their caliber. The arterial blood in the capillaries is then exposed to the reducing action of the surrounding tissues sufficiently long to become transformed into venous blood, thus causing cyanosis. Cyanosis is not due to methæmoglobin, but to the familiar cause of this phenomenon—*e.g.*, the accumulation of CO_2, due, in turn, to excessive vasoconstriction.

When the adrenal system is unable, owing to congenital, acquired, or temporary susceptibility, or an organic lesion of either of its component parts, to withstand the violent stimulation to which antipyrine subjects it, the functions of the adrenals may suddenly cease under the influence of even small doses of the drug, and the symptoms of adrenal failure appear. Antipyrin, in the stage of depression, reduces the temperature by causing adrenal insufficiency. The resulting dilatation of the great central vascular trunks causes depletion of the peripheral capillaries, and the internal temperature is thus raised, while that of the surface is lowered.

Antipyrine should not be used during toxæmias, especially when fever is present. It only acts as an antipyretic by causing excessive hyperæmia of the adrenals: a condition exposing the patient to general collapse, even when small doses are administered. C. E. de M. Sajous (Monthly Cyclo. of Pract. Med., May, 1904).

Antipyrine Poisoning. — The use of antipyrine is not always void of danger. Very unpleasant, even dangerous and fatal results are on record. The dose

does not always determine the effect produced, and it would seem that some persons are extremely susceptible to its toxic action. In addition to idiosyncrasy, a diseased condition of the brain, heart, or blood-vessels, and especially of the kidneys (organs eliminating antipyrine) seems to heighten the effects of the drug on the system, so much so as to interdict its use altogether.

> Antipyrine is a dangerous drug. It ought to be scheduled as a poison, only to be dispensed on a written order from a qualified medical practitioner. By combining some preparation of ammonia with antipyrine, the latter drug can be prescribed with less fear of unpleasant sequelæ. H. W. McCaully Hayes (Brit. Med. Jour., Feb. 1, '96).

The toxic effects of antipyrine when ingested are, in general, those of an irritant poison: abdominal pain, nausea, heart-burn, and in some cases vomiting, intense colic, and diarrhœa. These effects may be avoided by rectal administration of the drug. In addition to these effects upon the gastro-intestinal tract, we notice a diminution of body-heat, in some cases becoming subnormal, the skin becoming cold, cyanotic, and covered with a clammy perspiration, sometimes followed by unconsciousness, collapse, coma, convulsions, and even death. In rare cases an elevation of temperature follows its use (paradoxical action), possibly due to interference with renal function and the presence of urea or leucomaines in the blood; several cases of this action have been reported. The administration of 15 grains has been followed, in several cases reported, by violent sneezing, a copious watery discharge from the eyes and nose, constriction about the throat, loss of voice, and dyspnœa, with a sense of intense burning in the nose, mouth, eyes, ears, and throat and distressing tinnitus aurium. Vertigo attended by dyspnœa, and a feeble, fluttering, and intermittent pulse are not infrequently observed. Disturbance of the vasomotor system is observed in some cases, resulting in œdema (sometimes of the glottis, causing suffocation) of the extremities or face with a diminution in temperature and a tendency to cyanosis and collapse.

> Case of poisoning by antipyrine. Within a quarter of an hour after taking a dose of 10 grains the patient felt very ill. His face was cyanosed, his lips and nose swollen and blue, and his eyes almost closed from swelling of the eyelids; skin was cold and clammy; sweating; pulse, 128, very weak, small, and compressible. Pupils widely dilated. Administered 5 grains of carbonate of ammonia, $^1/_{60}$ grain of digitaline, $^1/_{60}$ grain of strychnine, and $^1/_2$ ounce of vinum aurantii. The next quarter of an hour his condition improved as far as the symptoms of cardiac depression were concerned. Recovery. H. W. McCaully Hayes (Brit. Med. Jour., Feb. 1, '96).
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> Case of an anæmic girl of 19, who took a draught containing 5 grains of antipyrine and 7 grains of bromide of potassium, with a drachm of compound spirit of ammonia. Toxic symptoms appeared about ten minutes after the draught was taken. A few minutes later the following conditions were present: Cold shivers, severe and gasping dyspnœa; the face was swollen, especially about the eyes, so much so as to prevent any possibility of opening them or of seeing, except with great difficulty, the pupil; and the body was covered with a bright-red rash, like scarlet fever, resembling that of urticaria, so that it presented wheals, which were of different sizes: from that of a small papule to some as large as five-shilling pieces. The temperature in the axilla was 97° F., and the pulse, which was very intermittent, was only 50. She complained of no pain. The tongue was very dry. The lips and general aspect were decidedly cyanotic. Stimulants, with strychnine and digitalis, were given. The shivering passed off in about three hours, but the other symp-

toms continued for about eight hours. The rash did not disappear for thirty hours. E. Webster (Lancet, Jan. 30, '97).

Poisoning by antipyrine in a middle-aged woman, convalescent from typho-malarial fever. After taking 10 grains of antipyrine, 20 minims of spiritus ammoniæ aromaticus, and 1 ounce of water, she was very pale, but not cyanotic; no swelling of the eyelids, but almost complete loss of sight; rash, which disappeared in about eighteen hours, resembling that of urticaria. Patient rallied well on the administration of hot coffee and whisky. Recovery. F. G. Wallace (Lancet, Feb. 6, '97).

Case of a woman, aged 50 years, poisoned by 7 grains. After an hour: swelling and redness of the upper lip. After three hours: pain in the eyes; paralysis, swelling, and smarting of the tongue. Speech difficult; salivation. An hour later: chilliness, sensations of heat; and, later, syncope, vomiting, and diarrhœa. The next morning there was an eruption upon the face, arms, hands, and thighs which resembled scarlet fever, with marked burning and itching about anus and vulva that gradually extended over the whole body. These symptoms gradually disappeared in two weeks. Severe desquamation. Scheel (Ther. Monat., H. 3, S. 161, '97).

Case showing that antipyrine may unexpectedly prove poisonous in a small dose (7½ grains, in this instance) in a person who has shown no special idiosyncrasy toward it, after taking the drug on many previous occasions. Eisenmann (Ther. Monat., Apr., '97).

Case in which a dose of 10 grains of antipyrine caused acute pain in the abdomen, emesis, and rapid swelling of the face, almost closing the eyes. This was followed by two periods of collapse, one lasting a half-hour. Recovery followed. The patient had taken similar doses before with no ill effect. H. Blakeney (Brit. Med. Jour., July 8, '99).

The toxic action of antipyrine on the blood seems to be a transformation of its oxyhæmoglobin into methæmoglobin.

The action of antipyretics on the blood when administered in toxic doses may be summed up as a transformation of oxyhæmoglobin into methæmoglobin. A phase of anæmia, or diminution of oxyhæmoglobin, precedes the accumulation of methæmoglobin. In this period there is at the same time production and elimination of methæmoglobin; if elimination be hindered or transformation be too rapid, phenomena of cyanosis may be produced which must be distinguished from those of the period of intoxication. Hénocque (La Semaine Méd., Mar. 27, '95).

Blood of frogs and blood taken from the cyanosed lips and other parts of a rabbit, both ante- and post- mortem, examined spectroscopically. The rabbit had died from toxic effects of antipyrine, yet the spectrum of methæmoglobin was certainly not present. Andres Halliday (Montreal Med. Jour., July, '97).

The poisonous effects of antipyrine upon the nervous system have been studied by Langlois and Guibaud. By graduated doses, given to animals whose spinal cord had been divided below the medulla oblongata, they discovered several stages of antipyrine poisoning. First, a cerebral stage, in which clonic epileptiform convulsions are limited to the head; second, a cerebro-spinal stage, in which the head is still affected with clonic convulsions, while the trunk is attacked with one or more tonic spasms (opisthotonos); third, a cerebral stage, with spinal hyperirritability, in which the shocks caused by the clonic convulsions of the head set up violent reflex movements of the body, comparable to the spasms of strychnine poisoning; fourth, the reflexes of the head disappear at the same time as those of the trunk. Antipyrine has, then, an elective action in the higher centres, and this explains why its sedative action is more marked in head affections than in spinal.

The deleterious effects manifested in the cutaneous system are very varied. There may be merely a sensation of great

itching or burning without the appearance of any eruption, which disappears rapidly upon the discontinuance of the drug. If an eruption appears, it may take the form of erythema, urticaria, petechiæ, or papule, or resemble in appearance one of the exanthemata: measles, scarlatina, etc. In rare cases we note discoloration of the face and of the mucous membrane of the mouth, swelling of lips, tongue, and salivary glands, with epileptoid attacks, amaurosis, tinnitus, deafness, and delirium. In rarer cases the ingestion of antipyrine is followed by the appearance of albuminuria, hæmaturia, ischuria, or strangury.

Urticaria produced rapidly by a single dose of 10 grains of antipyrine. E. Knight (Brit. Med. Jour., May 18, '95).

Case in which entire surface of the body was covered with a copious eruption exactly resembling in appearance that of a severe case of measles; the face and eyelids were also swollen, after taking 10-grain powders of antipyrine twice daily for three weeks. No symptoms of cardiac depression appeared to be produced by the drug. Webber (Lancet, June 6, '96).

Case of a gouty person of 65 years, who had often taken antipyrine without bad effects. One day a dose of 30 grains caused aphthous stomatitis, while an injection of 15 grains produced an ulcerative stomatitis with a purpural eruption. Dalche (Med. News, Feb. 13, '97).

Case of a woman of 33 years, who, several hours after the ingestion of antipyrine, developed a general pemphigus-like eruption upon the skin and also upon the buccal mucous membrane. This condition lasted ten days. There was also a scanty urine, but no albuminuria. Opinion that eruptions are only likely to occur in persons with renal lesions. Lyon (L'Abeille Méd., Mar. 27, '97).

Case in which there was œdema of the lower extremities and the vulva, with blebs forming under the skin after full doses. These symptoms ceased when the drug was stopped. Goldschmidt (L'Abeille Méd., Mar. 27, '97).

Case of a woman who had syphilis in 1894, for which she was thoroughly treated. Near three years later syphilitic manifestations appeared, which disappeared under treatment. In April, 1898, she took 7 ½ grains of antipyrine on account of headache, and on following day had a crop of vesicles in the mouth, which soon disappeared. A few days later she took another dose of 7 ½ grains of antipyrine. In the same evening she shivered, and was feverish, and had an urticarial eruption over the body. On the next day there were numerous vesicles on the mucous membrane of the cheek, soft and hard palate, upper and lower lips, and also on the vaginal mucous membrane. Patient thought this relapse of the syphilis. In four days vesicles began to dry up, but food was taken with difficulty. Urticaria-like rash had now disappeared. Nothing but simple treatment used. Immerwahr (Berliner klin. Woch., Aug. 22, '98).

Case of sudden death during pregnancy when the patient had taken a large dose of antipyrine and had a purpuric rash. The case is of much importance to the toxicologist; many women take quantities of antipyrine without medical advice, while the causes of sudden death during pregnancy are often subtle and may lead to judicial inquiries. (Comptes-rendus de la Soc. d'Obstét., de Gynec., et de Péd., Oct., 1903.)

In some cases there is a marked resemblance between antipyrine poisoning and the algid stage of cholera.

The dangerous and uncertain action of antipyrine in many cases renders precaution highly necessary. When the drug is known to disagree its use should be avoided. When disease of the heart, functional or organic, or of the kidneys is present, antipyrine should not be given or if necessary or expedient, it should be carefully guarded by administering stim-

ulants simultaneously. During lactation antipyrine should not be given unless we wish to control the function or cause the milk to disappear.

> Antipyrine in nineteen cases to suppress the lacteal secretion. It was given every two hours in capsules containing 4 grains, and a longer interval was allowed to pass between the dose which preceded and that which followed the two meals of the day. The results in all the cases were very favorable. After the absorption of the antipyrine the breasts became empty and soft, and the lacteal secretion was completely exhausted. Antipyrine is one of the most inoffensive medicaments for the suppression of the lacteal secretion known. Guibert (Jour. des Prat., Apr. 17, '97).
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> Antipyrine certainly passes in a natural state into the milk. Given in large doses, in two capsules each containing 15 grains, at intervals of two hours, it may be detected in the milk in from five to eight hours after its ingestion, while from nineteen to twenty-three hours afterward none can be found; hence elimination lasts eighteen hours at the maximum. The antipyrine during this time passes into the milk only in an excessively weak proportion, very much less than fifty parts in a thousand; it is only in exceptional conditions—for instance, when 60 grains are administered in sixteen hours—that it perceptibly reaches this proportion. It does not influence, in any way, the quality of the milk and, particularly, the lactose, the casein, or the fat. It seems to have no action at all on the secretion, which always remains very abundant, provided the woman continues to nurse. From the absence of general symptoms and from examinations of the weight, the infinitesimal quantity absorbed by the nursling does not seem to have any unfavorable action. M. G. Fieux (Bull. Méd., Sept. 5, '97).

Arteriosclerosis and depressed conditions of the system (typhoid fever associated with weak heart, typhoid pneumonia, etc.) contra-indicate the use of antipyrine.

Treatment of Antipyrine Poisoning.— If a patient is already suffering from antipyrine poisoning our chief reliance must be placed upon stimulants: brandy, ether, ammonia, atropine, and heat applied to the extremities seem best to meet the indications. As the symptoms are those of collapse, all efforts should tend toward the restoration of body-heat and normal heart-action. The presence of any renal difficulty will suggest its own appropriate treatment, in addition to that used primarily to combat the toxic effects of the antipyrine on the heart. Sodium bicarbonate is recommended as an antidote to antipyrine by Lépine, of Lyons, who prefers it to atropine.

Local Use. — Saint-Hilaire and Coupard have employed antipyrine locally in affections of the throat and larynx attended with symptoms of exaggerated sensibility, and have demonstrated its anæsthetic properties. They advise a solution of 1 part of the drug to $2\,^1/_2$ parts of distilled water, used in an atomizer. Cazeneuve, of Lyons, has found antipyrine serviceable in cystitis with ammoniacal urine used in a 4-per-cent. solution. The pain is diminished and the character of the urine modified.

> For operations in the pharynx and larynx, a 10-per-cent. solution of cocaine should be applied, followed by parenchymatous injection of 50-per-cent. antipyrine, the dose of the latter being 3 to 6 grains. Complete local anæsthesia ensues in from 10 to 15 minutes and lasts 8 to 12 hours. Wroblewski (Medicine, Feb., '98).
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> In cases of acute tonsillitis a gargle, composed of $2\,^1/_2$ drachms of antipyrine, $2\,^1/_2$ drachms of chlorate of potassium, 3 ounces of peppermint-water, and 8 ounces of distilled water, is useful whenever the painful crises occur.
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> As a substitute for cocaine in a number of cases of urethrotomy, a 10-per-cent. solution of antipyrine in 1-per-cent.

solution of carbolic acid used. The solution appears to be quite as efficacious as cocaine. The solution should be fresh, and should be allowed to remain in the urethra for ten minutes, as a rule. Unlike cocaine, the styptic effect of antipyrine is not followed by vascular relaxation and often almost uncomfortable hæmorrhage. G. Frank Lydston (Jour. Cut. and Genito-Urin. Dis., May, '98).

As an anæsthetic in cases of parturition, antipyrine is useless for the pains of a perfectly normal labor, but finds its chief value in those cases where the pains are so excessive as to reflexly interfere with the proper uterine contractions. It is also useful when the liquor amnii has been discharged too early and where there is rigidity of the os. In regard to the second stage of labor, antipyrine is useless. There is evidence, however, that antipyrine has considerable ability to relieve the so-called after-pains. It is also seemingly a fact that antipyrine may be used with some success for the purpose of quieting a tendency to the development of pains before the full term has been reached. If it is intended to use antipyrine for the purpose of arresting a threatened miscarriage, then its dose must be very large: as much as 30 or 40 grains given in two or three doses of 15 grains each, at half-hour or hour intervals. (Misrachi, Hare.)

Antipyrine has a powerful hæmostatic action when applied locally. It acts by vasoconstriction and retraction of the tissues, with the formation of a minute clot, which is extremely retractile and aseptic. In epistaxis antipyrine may be employed in a 20- to 50-per-cent. solution to the bleeding-point by means of a tampon. For ordinary use as an hæmostatic, a 10-per-cent. solution is sufficient. Park, of Buffalo, advises a sterilized 5-per-cent. solution used as a spray, on compress, or as injection.

Antipyrine is particularly indicated in epistaxis, in a $^1/_2$ or $^1/_4$ solution to the bleeding-point by means of a tampon. For ordinary use as an hæmostatic a $^1/_{10}$ solution is sufficient. It is also of value in dental, tonsillar, and uterine hæmorrhages. X. Grépin (Thèse de Paris, July, '95).

Hypodermic Use.—Antipyrine has been used subcutaneously in various affections, but its use in this way is followed by excruciating pain, which lasts about half a minute, and by abscess and gangrene in some cases. Such injections are believed to be particularly injurious where neuritis is the prominent lesion.

Since the beginning of hypodermic treatment, some way of administering quinine in this way needed, especially in severe malaria. The difficulty may be overcome by using Laveran's formula (hydrochlorate of quinine, 3; antipyrine, 2; distilled water, 6), giving a 50-per-cent. solution, of which the injection is painless. This solution, extensively used by Blum in 1894 during a severe malarial epidemic in Algiers, was always found satisfactory Santesson (Deut. med. Woch., B. 2, Sept., '97).

Therapeutics.—As already stated, antipyrine is especially useful in reducing very high temperature when unassociated with weak heart. For this reason it is valuable in the typhoid fever of children. It not only causes the desired reduction in temperature, but also has a happy effect in calming the restlessness and distress caused by the action of the toxins upon the nervous system. In the pneumonia of children it has been found to be equally valuable, and it is a desirable remedy in the fever accompanying the exanthemata (measles, scarlatina, etc.).

In healthy children antipyrine is the most active drug in causing perspiration; next in activity is phenacetin; sodium salicylate and quinine show scarcely any influence whatever; acetanilid causes a diminution. In febrile children acetanilid increases the perspiration most;

antipyrine not to the same degree; while sodium salicylate, quinine, and phenacetin cause suppression of the secretion. Ssokolow (Wratsch, Nos. 14, 16, 21, '93).

In influenza it not only controls the febrile movements, but relieves the pain and quiets the nervous system, but its depressing effects are sometimes harmful. In the hectic fever of tuberculosis it will sometimes be useful; but, as it influences the extension of the disease but slightly, if at all, and causes profuse diaphoresis and depression, other remedies are to be preferred.

Nervous Disorders. — It is in the treatment of neuralgia that antipyrine finds its best place. In hemicrania, sciatica, lumbago, the fulgurant pains of locomotor ataxia, the neuralgic pains of dysmenorrhœa when of ovarian origin, and in pains of nervous origin generally, antipyrine will be found of great value, being both efficient and prompt in its action. Small doses, from 5 to 10 grains every four hours are generally efficient. If ineffectual, the dose should be increased with caution, or the interval between the doses be shortened. In spasmodic conditions referable to the nervous system, bronchial asthma, laryngismus stridulus, pseudo-angina (not in true angina), and idiopathic epilepsy the following combination has been recommended by H. C. Wood:—

℞ Antipyrine, 6 grains.
Ammonium bromide, 20 grains.—M.

To be administered three times a day.

Forty-three cases of idiopathic epilepsy, in which the most excellent results were obtained by a combination of antipyrine and bromide of ammonium, as first suggested by H. C. Wood. The combination did not fail to give relief in a single one of the cases reported, and neither bromism nor the disagreeable effects often produced by antipyrine were observed. The dose employed in adults was 6 grains of antipyrine and 20 grains of bromide of ammonium three times a day. Charles S. Potts (Univ. Med. Mag., No. 1, '90).

Beneficial effects in forty out of sixty cases, but in three-fifths of these cases the affection recurred. One-half to 1½ drachms well tolerated for some weeks. Leroux (Revue Men. des Mal. de l'Enfance, June, '91).

[Antipyrine in 15-grain doses is probably the best of all drugs in systematic dysmenorrhœa, especially if accompanied by headache. E. E. Montgomery, Assoc. Ed., Annual, '94.]

Tried in an obstinate case of puerperal coccygodynia of two years' duration in which extirpation of the coccyx was seriously contemplated. Immediately after the first injection of a Pravaz syringeful the pain markedly decreased, while after a third it disappeared altogether and never recurred. Goenner (Corresp. f. Schweizer Aerzte, Jan. 25, '95).

Case of exophthalmic goitre with peculiar eye-symptoms. Under antipyrine treatment retraction of the upper lid (Stellwag's symptom) disappeared, while failure of lid to descend upon downward movement of the eye (Graefe's symptom) remained unchanged. J. Hinshelwood (Brit. Med. Jour., Aug. 20, '98).

Antipyrine is essentially a nervine, and acts as an analgesic and antispasmodic. In pertussis, therefore, it is plainly indicated. By diminishing the irritability of the superior laryngeal nerve, which, by reflex, produces the cough, it arrests the attacks of coughing and prevents secondary symptoms. This action on the nervous element of the cough is the least disputed of the effects of antipyrine in pertussis. Of eighteen patients seen by le Goff, in seventeen the number of attacks and their intensity diminished considerably, and in nine recovery occurred in less than twenty-five days, thus considerably reducing the duration of the disease. Antipyrine being an antiseptic, the in-

fectious principle of the disease is also reached.

Fifteen cases treated with antipyrine with marked success, the drug proving inefficient in only one instance. In some cases the effects were really astonishing; this was especially the fact when treatment was commenced in the early stages, at a time when medication is generally useless. In many instances the disease appeared to be aborted, and in others it was rendered so mild as to be insignificant. J. P. C. Griffith (Ther. Gaz., Feb. 15, '88).

Antipyrine employed in 300 cases of pertussis in which 196 patients were cured or benefited. The average duration of the treatment was thirty-five days. From 5 to 15 grains for children up to 3 years of age, and from 30 to 60 grains for older children and adults. The only symptom observed to follow the use of antipyrine is albuminuria, which appeared in two cases; it disappeared, however, rapidly after the cessation of the use of the drug and the establishment of a milk diet. Le Goff (Gaz. Heb. de Méd. et de Chir., Oct. 22, '96).

In mental diseases antipyrine is contra-indicated, its depressing influence upon the nervous system tending to aggravate the pathological process.

It sometimes prevents hallucinations and other sensory disturbances of reflex origin. In most cases, however, no effect is produced or the symptoms are aggravated. Marandon de Montyel (Bull. Gén. de Thér., Apr. 30, '93).

Antipyrine in doses of 15 grains renewed in two hours recommended to produce sleep. One to 1½ drachms frequently given per day for a fortnight at a time, without ill effects. J. B. Tuke (Edin. Med. Jour., Feb.-June, '94).

Rheumatism. — In the treatment of rheumatism and gout antipyrine holds a well-recognized position of merit, relieving the acute pains incident to those affections and controlling the fever as well. It is, however, less desirable than the salicylates in rheumatism or colchicum in gout, and, moreover, is not devoid of serious danger if there be any lesion of the heart or blood-vessels.

It often seems to act specifically in acute and subacute rheumatism, after salicylic acid has failed. R. Hirsch (Ther. Monat., Oct., '88).

Case in which the temperature twice rose to 106° F., and was reduced by 10-grain doses of antipyrine. A. E. Godfrey (Brit. Med. Jour., Nov. 4, '93).

Antipyrine used subcutaneously: 15 minims to 30 minims, followed by massage at the point of injection, used in 130 cases of lumbago; 122 cured. The syringe should be carefully cleansed after use, as the antipyrine will ruin the instrument if allowed to remain. Excruciating pain is produced, but it continues but half a minute. Bergquist (Eira, vol. xiv, No. 3, '95).

Diabetes.—Antipyrine has been recommended in the treatment of this affection, but its merits as regards the permanency of results have not been sustained by the experience of clinicians at large. Its continued use is likely to give rise to untoward symptoms.

It is valuable in diabetes, the glycosuria and other symptoms promptly and markedly diminishing under the use of the drug. Pousson (Jour. de Méd. de Bordeaux, Oct. 11, '91).

While the favorable influence exercised is not to be doubted, the gastric intolerance manifested by a number of cases prevented its continuance. Vergely (Jour. de Méd. de Bordeaux, Oct. 13, '91).

Antipyrine, in doses of from 5 to 7½ grains, must not be continued more than eight to ten days. J. Mayer (Centralb. f. d. Gesammte Ther., July, '92).

C. Sumner Witherstine,

Philadelphia.

ANTITOXINS. See Diphtheria, Tuberculosis, and other diseases in which they are used.

APHASIA. — From Gr., α, priv., and φημὶ or φάω, I speak.

Synonyms.—Aphrosia; alalia.

Definition.—A partial or total loss of the power of expressing one's self in speech or of understanding speech, which is dependent upon cerebral disorder.

Varieties.—There are two chief divisions of the affection: motor, or emissive or projective, aphasia and sensory, or receptive or subjective, aphasia. Each of these varieties includes at least two elementary forms: aphemia and agraphia, as motor subdivisions, and visual aphasia, or word-blindness (alexia), and auditory aphasia, or word-deafness, as subvarieties of sensory aphasia. The motor aphasia may be complete (aphemia) or there may be only some partial defect in the emissive mechanism of speech (dyslexia, paralexia, articulative ataxia, paraphasia, paralalia). The agraphia may likewise be complete (agraphia) or partial (paragraphia, dysgraphia). Pantomimic speech, so called,—which is an emissive form of speech in gestures, signs, etc.,—may be affected totally (amimia) or partially (paramimia) also. The more elaborate subdivisions of sensory aphasia are based upon qualitative rather than quantitative impairment. In the older literature all forms of sensory aphasia were referred to collectively under the term "amnesic aphasia," which included loss of the pictorial memory of letters and words and of the sounds of letters, words, and music. It included, also, loss of the power of understanding the meaning of figures, written music, and other symbols. In the more recent literature of the subject the term "amnesic aphasia" has been rather arbitrarily restricted to a loss of the naming rather than the ideational functions of speech-memory. Loss of the ideational faculty is expressed by the term "apraxia" (mind- or soul- blindness). Both sensory and motor aphasia may be divided, as regards the anatomical basis, into the cortical and subcortical varieties. The terms "conceptional" and "conductive" are practically of identical significance with the terms "cortical" and "subcortical."

Symptoms.—Motor Aphasia (Aphemia). — In motor aphasia the voluntary act which must be carried out to give expression to thought by the phonetic coordination of the muscles of the larynx, tongue, soft palate, and lips is not performed. The patient is seldom unable to produce sound, but he can no longer produce an articulate sound. Although he understands what is said and can think, he is unable to give expression to his thought; it may be possible for him to pronounce letters or even meaningless words,—he may even retain some words,—but these are usually interjections of some kind. In some cases, nouns only or verbs only are forgotten. One language may be forgotten and another remembered. This variety of aphasia is usually encountered in persons who are affected with right hemiplegia. In some, however, who are left-handed, there may be left hemiplegia. In some cases, although speech is impossible, the patient can articulate in singing, especially if certain well-known airs are sung, the words in that case having become intimately connected with the notes.

Case of aphasia in a child which, though unable to utter a single word as regards spontaneous speech, could articulate in singing. Knoblauch (Jour. of Nerv. and Mental Dis., June, '92).

Case of total aphasia of articulation in which the patient was able to intone the voice intelligently, as one does in speech. No agraphia; words readily understood. Brissaud (La Semaine Méd., Aug. 1, '94).

Case of traumatic aphasia dependent upon sun-stroke. Three attacks have occurred in which the patient became un-

conscious, and was paralyzed in the right arm, leg, and lower part of the face. While recovering consciousness he began to speak in Norwegian: a language that he had not used for many years. Later his language was a conglomeration of English and Norwegian. Eventually he recovered completely. E. Mackey (Brit. Med. Jour., Dec. 10, '98).

Aphasia may occur in uræmia, and is at times the sole expression of that state. It is frequently associated with right-sided motor paralysis, hemiplegic or monoplegic in character. It may be the precursor of uræmic convulsions or coma. The aphasia is usually of the motor type, but it may be sensory. There may be word-blindness and word-deafness. It may be associated with agraphia, even when there is no paralysis of the limbs. It is comparatively frequent in children, particularly in cases of post-scarlatinal nephritis. In adults it may occur in any form of Bright's disease. It is generally transient, disappearing completely. In time it is intermittent and has a marked tendency to recur. When paralysis is present the two may disappear simultaneously, usually the aphasia first. The features of uræmic aphasia are, *per se*, not characteristic of the causal condition. The most important diagnostic features are the transitoriness of the aphasia and the presence of other uræmic symptoms and of signs of nephritis. In every case of sudden aphasia, the possibility of its being renal in origin should be considered, and careful studies of the urine and of the system at large should be made with this thought in mind. D. Riesman (Med. Record, June 14, 1902).

AGRAPHIA.—Agraphia consists in the loss of the memory of the necessary movements to write. In an uncomplicated case the patient is able to speak, hear, or read as usual, but when he tries to write he finds that he can no longer do so, though he is capable of copying letters or designs placed before him. Pure agraphia is uncommon. It is usually associated with some degree of aphemia. Agraphia can only occur in those persons whose education is sufficiently advanced to enable them to write automatically.

In a thesis written under the direction of Déjerine the following conclusions reached:—

The centres of the images of language (motor centres for articulation and visual and auditory centres) are grouped in the convolution about the fissure of Sylvius, forming the zone of language.

Any lesion of this zone gives rise to an alteration in the interior language and consequently to manifest or latent alterations throughout all the modalities of language (speech, hearing, writing) with special predominance over the function of the directly destroyed images. Agraphia is always present. These form the class of true aphasias.

The class of pure aphasias (motor, subcortical aphasia, pure word-blindness of Déjerine, pure word-blindness) are located outside the zone of language and leave untouched the inner language. They never cause agraphia and affect only one of the modalities of language. They form a group apart from the true aphasias. Nothing would tend to show the existence of a motor centre for graphic images. Both clinical observation and pathological anatomy agree as to its absence.

The existence of pure agraphia has not yet been established. Mirallié (Revue des Sci. Méd. en France et à l'Etranger, July 15, '96).

AMIMIA.—Sign-language, as practiced by deaf-mutes in gestures and pantomimic speech generally, may be affected by a cerebral lesion. Loss of pantomimic speech is often co-existent with aphemia or agraphia or both. It is rarely or ever found alone, although it is quite possible to conceive of its separate existence in one in whom this faculty had been especially cultivated. (Mills.)

SENSORY APHASIA.—*Auditory Aphasia.*—This variety is more rarely met with than motor aphasia. Both the re-

ception and production of audible speech are deficient, the leading symptoms being, on the receptive side, word-deafness and, on the productive side, word-amnesia and articulative amnesia.

Speech and separate words are distinctly heard by the subject, but no meaning is attached to them. Sounds, however,—such as that of an engine-whistle, an alarm-clock, the hour,—are heard and recognized. Right hemiplegia and a certain amount of word-blindness are frequently present. Certain cases of auditory aphasia hear as if spoken to in a foreign tongue, but they cannot understand what is said, although they endeavor to do so. Other patients understand neither what is said to them nor what they themselves say, but can repeat words after another. They repeat like parrots (echolalia) what is said; but, if the centre of articulate voice is still partially connected with the sensory centres of audition and the latter are normal, the repetition of the word may suddenly give rise, in their mind, to the idea conveyed by the word. Instead of articulate speech the phenomena may show themselves in connection with music or numbers. In subcortical word-deafness the patient hears, but does not understand. He can, however, repeat at once whatever he hears, and write it down. While writing or speaking he may understand the words used, but not after the mechanical act is accomplished.

Case of woman, aged 72 years, who had been deaf since childhood, and remained so until within six weeks of an apoplectic attack. Hearing during this period of six weeks had returned and remained. After the apoplexy she was found to be absolutely word-deaf. There were also motor aphasia and agraphia, with word-blindness. Shaw (Brit. Med. Jour., Feb. 27, '92).

[This case presents several features of interest, among which may be noticed the return of hearing six weeks before the last stroke, to disappear again on its supervention; the remarkable picking out by the lesions of the several cortical areas, which by various observers have been associated with the faculty of language corresponding with the clinical phenomena recorded,—the second frontal convolution with the agraphia, the third frontal with the aphasia, the angular gyrus with the word-blindness, the temporo-sphenoidal with the word-deafness and general deafness,—and the apparent recognition by the patient of the total failure to make herself understood, this last feature being somewhat noteworthy in view of the extensive nature of the cortical lesion. L. C. Gray and W. B. Pritchard, Assoc. Eds., Annual, '93.]

Medico-legal conclusions drawn from a consideration of aphasia:—

1. Organic diseases of the brain may render a patient incapable of making a will, and that some form of aphasia may be produced also as one of the symptoms of the organic disease.

2. Some forms of aphasia may render a patient incapable of will-making.

3. Auditory aphasia, if at all well marked, incapacitates a patient from will-making.

4. Some other forms of aphasia, such as pictorial word-blindness, pictorial motor aphasia, and graphic aphasia, may render a patient incapable of making a will, not necessarily from being mentally incapable, but from the difficulty of carrying out the legal formalities.

5. These difficulties in carrying out the legal formalities necessarily vary according to the law of the particular country.

6. Simple uncomplicated cases of infrapictorial auditory, infrapictorial visual, and infrapictorial motor aphasia are capable of valid will-making. William Elder (Brit. Med. Jour., Sept. 3, '98).

Case in which the patient, during the year preceding death, had numerous attacks of transient sensory aphasia. In the intervals there was no paraphasia, the language being correct, but he did not understand what was said to him. At autopsy general atrophy of the brain, with reduction of the size of the superior temporal convolutions, espe-

cially marked on the left side; also of the operculum and of the inferior frontal convolution. The case demonstrates that word-deafness is essentially of cortical origin. O. Veraguth (Deutsche Zeits. f. Nervenheilk., B. xvii, H. 2 and 4, 1901).

Word-blindness (*Alexia*).—The patient sees written or printed letters and words and may be able to distinguish one from another, but they no longer have any meaning for him. Word-blindness is rarely total, however, a few words or letters being usually understood, nor is the disorder often found existing alone. In nearly every case there co-exists either word-deafness or motor aphasia or some other complication of speech.

Word-blindness is often found in connection with right lateral hemianopsia, or concentric diminution of the field of vision. The patient can no longer read, but can write; as he cannot read what he has written the letters and lines are sometimes uneven and resemble those written with the eyes shut. In the right hemianopsia found in this connection the written lines always begin on the left side of the page. The visual memory of numbers may be preserved or may also be lost (*cæcitas numeralis*). Word-blindness can, therefore, be divided into two categories: in the one, the sense of the letter itself is lost (*cæcitas literatis*); as a consequence, persons who generally read slowly, and spell out each word, suffer the total loss of the power of reading. In the other, the accompanying hemianopsia prevents the general physiognomy of a word being rapidly taken in by the patient (*cæcitas verbalis*).

Subcortical Word-blindness. — In subcortical alexia the patient can read or copy, but he does not understand what he does until the movement of his hand awakens in his mind the sense of word-hearing and of motor articulation through the muscular sense.

In pure verbal blindness the meaning of the words may be lost, but, by following with the eye the form of the letters, the patient finally may spell out the word.

Four cases of word-blindness. The first occurred in a man 34 years of age. In this case the condition developed after an attack of left hemiplegia with paralysis of the left side of the face, from which he had been recovering gradually. The second case occurred in a man 57 years of age. The condition came on very suddenly during active exercises. It was ushered in by slight frontal headache and some mental confusion. The third case occurred in a man 60 years of age. The onset in this case was also abrupt. The fourth case occurred in a woman 34 years of age. In this case the onset was marked by unconsciousness, which remained for several days. Then consciousness was restored, paralysis in the right arm and right leg developed, and she was completely aphasic. J. Hinshelwood (Lancet, Feb. 8, 1902).

Additional form of visual defect in which there is not only word-blindness, but also failure to recognize the individual letters of words. Hinshelwood (Lancet, Dec. 21, '95).

Apraxia. — In apraxia (Kussmaul) the patient no longer recognizes the use of objects which he sees; a fork to him conveys no meaning of its use. Apraxia may affect other senses besides that of sight,—as, for example, hearing, taste, smell, etc.,—the sound of a bell may no longer convey a meaning or the taste of a dish.

Diagnosis. — In all cases of actual or suspected aphasia the patient should be examined as to his ability: 1. (*a*) To speak voluntarily; (*b*) to speak clearly and distinctly, pronouncing properly; (*c*) to repeat words dictated aloud. 2. (*a*) To write voluntarily letters, words,

numerals, and sentences; (*b*) to write from dictation; (*c*) to copy; (*d*) to understand what he has written. 3. (*a*) To understand words and sentences spoken; (*b*) to understand or recognize vocal and instrumental music; (*c*) to understand the use of objects named. 4. (*a*) To read words, letters, numerals, and musical symbols if previously familiar with them; (*b*) to call objects by their names; (*c*) to recognize the use of objects exhibited; (*d*) to read and comhend what is read. 5. (*a*) To name and recognize the use of objects felt, tasted, or smelt.

Word-deafness must be distinguished from deafness. If the patient does not suffer from aphemia, it will be at once perceived, from his ability to hear simple meaningless sounds, that he is not simply deaf. When word-deafness exists in combination with aphemia and word-blindness (this latter complication is uncommon) the diagnosis must be made between true word-deafness and apparent deafness with dumbness in a non-hemiplegic, demented subject.

If, however, the symptoms have followed an apoplectic stroke with right hemiplegia, the affection is probably word-deafness due to a cortical lesion.

Word-blindness, if isolated, is easily recognized.

Aphasia, or Aphemia.—Aphasia should be diagnosticated from (1) mutism due to melancholia; (2) mutism due to hysteria; (3) the silence observed in hemiplegic patients who speak with difficulty; (4) the silence observed in hemiplegic patients who are suffering from pseudo-bulbar paralysis of cerebral origin; (5) word-blindness associated with word-deafness. All these present individual characters which must be studied in connection with the general symptomatology of each affection.

Agraphia arising from a lesion of the centre of writing should be distinguished from (1) the inability to write due to hemiplegia and (2) the agraphia due to a lesion of the visual centre in patients of limited education and who copy visual images; (3) the agraphia due to a lesion of the auditory centre, in which the patient writes only what is mentally heard by him.

The co-existence of word-blindness or of word-deafness with agraphia should suggest that the latter might be due to a lesion of the sensory centres (visual or auditory), especially if the patient did not previously write automatically, for agraphia due to a pure lesion can arise only in cases in which automatic writing has caused the development of a special graphic centre.

Infracortical Motor Aphasia.—A pure motor aphasia without word-blindness or word-deafness is likely to be of infracortical origin. Cases, however, have been reported in which an infracortical lesion has caused aphasia, word-blindness, and word-deafness.

Etiology. — The various varieties of aphasia occur almost always as a manifestation of cerebral lesion. The most common factor is softening; next in frequency are cerebral tumors and, especially, syphilitic lesions (Fournier), cerebral hæmorrhage, traumatisms, and meningo-encephalitis.

Aphasia may present itself during enteric fever, small-pox, and puerperal fever. Transient aphasia — following epileptic or hysterical convulsions, migraine, or concussion of the brain—has been occasionally observed, and certain degrees of the affection may be temporarily present and even recurrent in states of profound anæmia of the cerebrum.

Case of mixed aphasia with right hemiplegia due to meningo-encephalitis from cysticercus, affecting principally the anterior extremity of the sphenoidal lobe. Bitot (Jour. de Méd. de Bordeaux, Dec. 15, '89).

Two cases dependent upon tubercular meningitis. Picot (Gaz. Heb. des Sci. Méd. de Bordeaux, Mar. 16, Apr. 13, 27, May 11, '90).

Case of mixed motor and sensory aphasia consequent on influenza. Recovery after several weeks. T. D. Poole (Edinburgh Med. Jour., Aug., '90).

Case of motor aphasia with graphia and dyslexia in conjunction with attacks of *petit mal*. Eye-strain. Improvement from properly adjusted glasses. Muehleck (Univ. Med. Mag., June, '91).

Case with right facial paralysis and right Jacksonian epilepsy due to injury over base of right parietal. Recovery in few weeks. Symptoms supposed to be due to contusion of left centres, from counter-stroke. Ransohoff (Cincinnati Lancet-Clinic, Apr. 16, '92).

Case in girl, aged 10, due to embolism. Suckling (Brit. Med. Jour., May 21, '92).

Four cases occurring during puerperal period, sixteen from literature; sometimes hysterical; in others, uræmic. In nearly one-half of the cases aphasia is associated with right hemiplegia and due to embolism or thrombosis. Having occurred in one pregnancy, it is liable to occur in the next, and usually appears about one week after delivery. Cowe (Archives de Tocol. et de Gyn., vol. xx, No. 7, '94).

Several cases of ataxic aphasia during pneumonia. In every case there was paresis and weakness of the right face and right arm. Cause supposed to be pneumococcus toxins. Chantemesse (Med. Record, Feb. 3, '95).

Case occurring as result of wound in left side of skull 9 centimetres from horizontal circumference, passing by superior border of auditory meatus and supra-orbital margins, 7 centimetres from sagittal suture perpendicularly, 1 ½ centimetres in front of left auditory canal. Spherical fragment separated and pressed down 1 centimetre into the wound. As soon as removed, speech became normal. Dorrenberg (Berliner klin. Woch., No. 18, '95).

Case of a woman, aged 20 years, who was infected, after her marriage, with gonorrhœa, and who was attacked with severe convulsive movements in the right side of the face and tongue and in the right forearm. The following morning there were present right hemiplegia and complete motor aphasia. Sensitiveness was preserved. The hemiplegia persisted and typical contracture occurring, but the paralysis of the facial and pharyngeal muscles improved. The aphasia improved slowly. After six months it was found that understanding of words was completely restored, that both writing and print could be read, only some mutilation of words remained after a certain time. Repetition of words was perfect. The left hand could be used to write grammatically with good orthography. Since the patient suffered from salpingitis due to gonorrhœa, the troubles described are undoubtedly due to a thrombosis. L. Bruns (Schmidt's Jahrbucher, B. 250, p. 236, '96).

In polyglottic patients suffering from aphasia the disturbances in speech do not always affect to the same degree all the languages spoken by the patients.

When recovery occurs, it does so usually systematically and progressively; the language that first returns is usually the one first learned. The patient begins by understanding before being able to speak. At times, however, there occurs an arrest in the process of recovery: the patient in such a case recovers only the ability to understand and then to speak the language usually spoken by him, or he may understand one or several languages, but be unable to speak them.

In such cases it is evident that there is no destruction of the cortical centres of speech, but only of shock to their elements. The varying intensity of such shock explains the gradation of the symptoms noted in the patients seen by the writer.

Consequently it is not, in general, necessary to claim the existence of multiple centres of speech, each one peculiar to one of the languages successfully learned by patients speaking sev-

eral languages. The paper is based on seven observations. A. Pitres (Rev. de Méd., Nov., '95; Revue des Sci. Méd., '96).

Case in which the patient, who had been under almost continuous observation for eighteen years, was almost completely aphasic. At the autopsy Broca's convolution was found to be intact. Bastian (Lancet, Dec. 19, '96).

Case of motor aphasia at the beginning of scarlatina, in a girl aged $3\frac{1}{2}$ years. The aphasia appeared on the fourth or fifth day of the eruption; this differs from the usual time of appearance, which is late: *i.e.*, about the time of appearance of renal symptoms, it being a symptom of uræmia. The speech-disturbance disappeared after fifteen days. Brasch (Berliner klin. Woch., No. 2, S. 30, '97).

Case of aphasia with frequent attacks of word-deafness and spasm of the right side of the tongue and face. At autopsy tumor was found in the lower part of the Rolandic fissure resting upon the first temporal convolution. Philip Zenner (N. Y. Med. Jour., Jan. 8, '98).

Case of a woman of 36, who was suddenly overcome while exposed to the sun, had a "sort of fit," from which she recovered and was able to walk to her bedroom. Prostration was extreme, and vomiting excessive whenever she moved; the temperature, which at first was subnormal, rose to 100° F., and finally became normal; pulse was slow. Speech gradually became difficult, and finally aphasia, alexia, and agraphia were complete. The skull was trephined over the speech center and an extensive intrameningeal hæmorrhage was found and drained. At the end of a week recovery was complete. Weigall (Austral. Med. Gaz., July 20, 1903).

Pathology.—Motor Aphasia.—Pure aphasia of articulation is due to a lesion of the foot of the third left frontal convolution (Broca's convolution). If the lesion affects more than this region, other symptoms are present. If the lesion occupy but a portion of the region, the aphasia may be partial only: for instance, nouns only will be missing. In persons habitually left-handed a lesion of the third right frontal convolution may produce motor aphasia. In persons who are ambidextrous the aphasia is of slighter degree and is more transient. The lesion may be either cortical or subcortical. As a rule, in the subcortical cases the defect is rarely complete.

Case in 4-year-old child. At the autopsy several tubercular nodules were found in brain, one being at the base of the left third frontal gyrus. Mosny (Bull. de la Soc. Anat., Mar., '88).

Case, lasting ten years, with distinctly causative subcortical lesion. Horizontal section through Broca's convolution showed at its base an old focus of softening, 1 centimetre in diameter and 2 centimetres from the cortex; 1 centimetre farther back was a second focus. A section 1 centimetre above the first showed an ancient, grayish focus in the white substance, on a level with the anterior half of the base of the third frontal, independent of the other two and on a plane anterior to them.

Second case, with centre of softening in the white substance to the third frontal, prolonged, on a level with the inferior extremity of the Rolandic fissure, into the foot of the ascending frontal convolution. Déjerine (La Semaine Méd., Mar. 4, '91).

Case of complete motor aphasia consequent on fall. Ability to use right hand to write; left hemiplegia. At autopsy left hemisphere found normal; right hemisphere injured. The man had never been left-handed. Luys (La Semaine Méd., Mar. 19, '91).

Case of motor aphasia (partial) with agraphia (complete), alexia (partial), and occasionally auditory aphasia. Right hemiplegia. Vast focus of softening in the left hemisphere. Motor aphasia explained by destruction of the third left frontal; motor agraphia by destruction of white matter connecting inferior parietal with second left frontal; partial auditory aphasia by destructive lesion involving first temporal lobe. Incomplete alexia due to destruction of inferior parietal lobe. Bernheim (Revue de Méd., May 10, '91).

Case with right hemiplegia, with temporary conjugate deviation of the eyes, excited by attempts to converge the eyes strongly toward the middle line. The autopsy proved this to be due to irritative implication, without destruction of the region shown experimentally by Ferrier, Horsley, Beever, Shafer, and Mott to be related as a centre to these movements. Delépine (Brit. Med. Jour., Sept. 10, '92).

Case of pure motor aphasia, with ability to read and write down thought fluently with the left hand, due to extensive softening, principally affecting the left frontal convolutions, extending deeply, even to the internal capsule in the white substance.

Case in accord with the statement that ability to understand words might be retained, with complete involvement of the frontal convolutions, and that agraphia does not, as claimed by some, belong to Broca's aphasia. Kostenitsch (Centralb. f. klin. Med., Mar. 31, '94).

Motor speech-centre capable of further subdivision into subareas representing various perversions of functions which are in relation, through isolated lesions, to the subtypes of motor aphasia, including the ataxic and amnesic, the agraphic and others. Wylie (Archives Clin. de. Bordeaux, Oct., '93, to May, '94).

Sole well-demonstrated anatomical localization is that of the foot of the left frontal convolution. Bernheim (Le Bull. Méd., Oct., '94).

Case of Jacksonian epilepsy accompanied by motor aphasia without agraphia, conclusively proving that the former may exist without the latter. There is too great a tendency to regard language as a special and isolated phenomenon among manifestations of nervous centres. Prévost (Revue Méd. de la Suisse Rom., June, '95).

Disturbances in fifteen cases of cortical motor aphasia due to destruction of Broca's convolution correspond exactly to the description given by Trousseau. Patients read as badly as they write. It is incorrect to maintain that they preserve ability to read mentally. Déjerine (Le Bull. Méd., July 10, '95).

Case of syphilitic apoplexy, right hemiplegia, motor aphasia, and word-blindness without blindness for words or objects. Visual field showed no contraction or hemianopsia. Lannois (Le Bull. Méd., Sept., '95).

Case of motor aphasia following influenza which occurred in a previously healthy woman. There were likewise present paresis of the right arm, and paralysis of the left vocal cord. Sensation was somewhat diminished on the right side of the face and in the right arm. The patient could neither speak, repeat, nor write a single word, but could understand everything and read both written and printed words. The symptoms were traced to two lesions: 1. To ulcerative laryngitis with peripheral paralysis of that branch of the inferior laryngeal nerve which supplies the posterior cricoarytenoid muscle. 2. To cerebral hæmorrhage which caused the aphasia and the paralysis of the face and arm. Kohan and Stembo (Schmidt's Jahrbucher, B. 250, H. 33, '96).

Case showing that associated movements of the arm and hand, which are observed in certain people when speaking, may be unusually prominent in pathological conditions of the speech-centres. R. Remak (Neurol. Centralb., Jan. 15, '97).

Case of a man who, since his childhood, had practiced the deaf-and-dumb language, employing his right hand almost exclusively. After the occurrence of a cerebral thrombosis, he was entirely unable to communicate with this hand, although the paresis was not great. With the left hand he still expressed himself without difficulty. Grasset (Med. News, Jan. 16, '97).

Case sustaining Pitres and Charcot's view that there must be a homologue of the motor speech-centres, viz.: a special graphic centre containing the memories of the motions required for the execution of written characters. Destruction of these memories causes inability to write in written characters, while writing with printed characters may be possible with the help of the visual letter- and word- memories. This centre of the graphic memories is, however, prob-

ably situated in close proximity to the arm-centre; possibly both may be contained within the same cortical area. B. Onuf (Jour. Nerv. and Mental Dis., Feb., Mar., '97).

There are four centres in the cerebral cortex which are concerned in the production of spoken and written language. Two of these, in the posterior parts of the cerebrum, correspond in position to the visual and (as far as is known) auditory centres, and are of the ordinary sensory type; the others, in the second and third frontal convolutions, respectively, are excitomotor centres for writing and speech. There is a system of commissures between the various centres, the value of which is exemplified by such actions as reading aloud and writing from dictation. When any particular

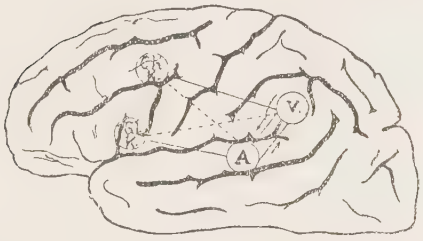

Diagram showing the approximate sites of the four word-centres and their commissures. (*Bastian.*)

channel is blocked, other commissures may take on the work. This is especially true of the callosal fibres connecting the two hemispheres. Aphasia depends either upon damage to one or other of the four centres in the dominant hemisphere, or upon interruption of the commissures connecting them. Attention called to the considerable power of reciprocal substitution possessed by the visual and auditory word-centres for the production of speech and writing, respectively, and to the fact that in all probability both auditory word-centres—and not, as formerly believed, the left alone—are accustomed to act on Broca's centre in the production of speech. H. C. Bastian (Lancet, April 3, May 1, '97).

Case of complete word-blindness; right-sided homonymous lateral hemianopsia; no agraphia, but inability to read own writing; optical aphasia; temporary mind-blindness; the ability to spell correctly completely retained.

Case of paralysis of the right hand and arm; aphasia; very marked word-blindness presenting the peculiarity that the patient could read many words (combinations of letters) while he was absolutely unable to recognize the individual letters of which they were composed, with some impairment of the motor side of the speech-mechanism; partial right-sided homonymous hemianopsia, with some peripheral constriction of the sound half of each field.

Case of word-blindness in a patient who had never learned to write; constriction of the fields of vision chiefly toward the right; no obvious word-deafness; cardiac and renal disease; death; extensive old softening in the white matter of the left occipital lobe and of the left angular gyrus, and the back part of the first temporo-sphenoidal convolution.

Case of word-blindness and agraphia; instead of reading individual letters as letters, the patient substituted a word commencing with the letter which he could not read—"George" for "G," "nearly" for "n," etc.

Case of sudden cerebral attack after confinement; absolute deafness to all sound for sixteen days; temporary motor aphasia and word-blindness; absolute word-deafness for four weeks; rapid recovery from the motor aphasia; partial recovery from the word-blindness; very slow and imperfect recovery from the word-deafness; slight paraphasia and slight paragraphia; echo speech; retention of the power of writing from dictation and of reading aloud; no hemianopsia; redevelopment of acute cerebral symptoms (meningitis or cerebritis) six months after the original attack; hyperpyrexia; death.

Sudden cerebral seizure due to embolic infarction in a man aged 25 years; temporary loss of power in the right side of face, right arm, and right leg; complete motor vocal aphasia; some—but, comparatively speaking, much less—agraphia; no word-deafness; no word-

blindness; complete recovery of the power of writing; gradual, but slight, improvement as regards vocal speech; second embolic attack four months afterward; increased paralysis of the right side of the face, of the right arm, and of the right leg; no increase of the motor vocal aphasia; marked increase in the agraphia; some word-blindness; no word-deafness; death four years after the original seizure.

Seven out of twelve cases supporting the view that the right hemisphere must be regarded as forming an active part of the nervous speech-mechanism; in other words, that the so-called speech-centres and speech-faculties are bilaterally represented. Byrom Bramwell (Lancet, Mar. 20, 27; April 10, 17; May 8, 22, '97).

Advisability of enlarging the zone of language, as given by Déjerine, so as to make it include a centre for concepts in the third temporal convolution, and possibly extending over more of the mid-temporal region, and, in addition, a graphic motor centre in the caudal portion of the second frontal convolution. This zone of language unquestionably has its deepest organization and highest development in the region encircling the Sylvian fissure, for here is situated the auditory centre, out of which the others may be said to have been evolved, and the motor, articulatory, and visual centres which are next in importance, as they have been next in development; but it must also include those portions of the brain in which concepts originate, and, if the views of those who believe in separate graphic motor centres are correct, also those parts in which graphic motor images are represented. Charles K. Mills (Medical News, June 5, '97).

AGRAPHIA. — True agraphia almost always occurs as a result of a lesion of the foot of the second left frontal convolution or of the subcortical fibres therefrom. Agraphia is generally found, however, associated with some form of motor aphasia, rarely existing alone.

Case of a woman, who, at 44, had an attack of right hemiplegia involving the tongue. She lost the ability to write

Series of perimeter charts in a case of complete agraphia and almost complete word-blindness, with right-sided bilateral temporal hemianopsia. (The black area represents the blind parts of the fields.) Chart 1 represents the fields of vision on Nov. 17th. Chart 2 represents the fields of vision on Nov. 24th. Chart 3 represents the fields of vision on Dec. 1st. Chart 4 represents the fields of vision on Dec. 8th. Chart 5 represents the fields of vision on Dec. 15th. (*Byrom Bramwell.*)

spontaneously and from dictation, but could copy. There was no word-deafness nor word-blindness. When 55, a second attack of hemiplegia occurred, this time of the left side, with complete loss of speech. A third and fourth attack occurred six years later, and death eight years afterward, at the age of 69. At the necropsy areas of softening were found in the left hemisphere (1) at the posterior extremity of the second frontal and (2) in the middle portion of the second frontal on the right side; (3) at the anterior extremity of the third frontal and posterior portion of the third frontal, extending into the ascending frontal (4) at the foot of the ascending frontal and parietal and (5) in the posterior portion of the ascending parietal. Two additional areas of softening were found at the base of the right hemisphere, but these, with No. 3, were supposed to have given rise to no symptoms. Nos. 2 and 4 caused symptoms of bulbar paralysis, No. 5 the left hemiparesis, while No. 1—the lesion at the posterior portion of the second left frontal—was considered responsible for the peculiar form of agraphia. Charcot and Dubreuihl (Annual, '94).

The above or similar cases reported do not prove that the centre for written language lies in the second left frontal. It is very difficult to isolate and localize a pure motor agraphia. Against the hypothetical existence of a centre for writing in the above case is the fact that no one could write with the feet as well as with the hands, although it can be conceived that a higher motor centre for writing may exist, connected with the lower centres for the hand and foot either of which may govern the peripheral mechanism of writing. The same type of agraphia had accompanied motor aphasia in this case, in cases in which the lesion was of Broca's convolution. Déjerine (Annual, '94).

Case of a man of 26 who had been violently pushed, the head striking forcibly against edge of a dresser. Injury was over right parietal eminence. For two or three days afterward showed the ordinary symptoms of concussion. Later he could not recognize letters or figures, nor name most things at sight, though he could point out anything named, and, a name being suggested, he repudiated the wrong one on every occasion. Spontaneous writing was confined to his own name, which he wrote quickly. He could neither write from dictation nor read aloud. He could copy, but could not transfer printed into written, nor written into printed, characters. The field of vision was normal in both eyes. No hemianopsia was present. Gradually the patient improved. Not until the man was able to read aloud was there any sign of understanding any written question. He could read aloud a few combinations of figures, such as 100 and 1897, and write 1897 down in well-formed figures, but he could not recognize individual figures at sight, nor put them down from dictation. This suggests the possibility of there being a distinct group of cells the function of which is to store combinations of figures which might be called the visual figure-combination-centre as distinct from the visual figure-centre. Four divisions of the visual nerve-centre might be made: (*a*) one for letters; (*b*) one for numerals; (*c*) one for words; (*d*) one for combinations of figures. One would naturally expect only two subdivisions: (*a*) a centre for letters and numerals; (*b*) a centre for words and figure-combinations. But Hinshelwood has noted that there are cases in which the visual memory for letters is entirely lost, while that for figures is intact, or in which the visual word-memory only was affected. C. MacVicar (Scottish Med. Jour., Nov., '98).

Sensory Aphasia. — Cortical word-deafness is usually caused by a lesion of the middle or posterior portion of the first and second left temporal convolution, chiefly the first. Auditory speech is not, however, so exclusively a left-brain function as is motor speech; hence the fact of incomplete and more transient types of speech-defect from unilateral lesions of this region. Lesions affecting the subcortical white fibres

from this area give rise to the subcortical type of word-deafness, as it is termed.

Case of lesion of the left temporal lobe in a left-handed man without word-deafness. Seppili (Alienist and Neurologist, Apr., '93).

Case of lesion of the first, second, and third right temporal lobes, with word-deafness. Many similar cases are reported in literature; two cases of lesion of the left lobe in left-handed persons, without deafness, and thirty cases with word-deafness from lesions of the left temporal lobe in right-handed persons. Scavano (Revue Inter. de Bibliographie, June 10, '93).

Case of deaf-mutism, in an adult, due to symmetrical lesions in the two temporal lobes. The first and second temporal convolutions were replaced by cicatricial tissue; the third was atrophied and sclerosed. Seppili (Alienist and Neurologist, Apr., '95).

Three autopsies in patients with sensory aphasia. There were softening and atrophy of the left first temporal convolution. Case of subcortical aphasia noted. The patient could not speak and had no comprehension of spoken language. He had right hemiplegia. Softening of the external capsule and lenticular muscles was found at autopsy. W. T. Worcester (N. Y. Med. Jour., Jan. 8, '98).

Cortical word-blindness is caused by a lesion of the postero-inferior portion of the second left parietal convolution (angulo-occipital region).

Lesions affecting the optic radiations of Gratiolet cause the subcortical variety of alexia. Interruptions of relations through commissural fibres with any of the associated speech-areas will, of course, result in one of the mixed forms of aphasia or in subcortical alexia.

Fifty cases of sensory aphasia in which Broca's centre was not found diseased. In all some form of sensory aphasia was present, and in all the lesion lay in the lower posterior third of the brain. The convolutions were found affected in the following order: The first temporal in 38, the second temporal in 27, the inferior parietal in 21, the angular gyrus in 25, the supramarginal gyrus in 12, the occipital lobe in 12. Paraphasia may be caused by lesions in various locations. Word-deafness due to a lesion of the first and second temporal convolutions, and word-blindness may be produced by lesions lying in the region of the inferior parietal lobule, or extending over, anteriorly from it, into the temporal region, or, posteriorly, into the angular gyrus and occipital lobe. Failure to recognize a word heard implies destruction of the temporal cortical area; failure to recall the name of an object seen implies the destruction of the temporo-occipital association tract in the subcortical white matter.

If the lesion be extensive enough to involve the cuneus, or deep enough to reach the visual tract to the cuneus as it passes beneath the angular gyrus and convexity of the occipital lobe, it will produce hemianopsia; if not, actual blindness may not accompany psychical blindness. In either case it is found that when things are not recognized they cannot be named when seen. The visual memory-pictures lie in the angular gyrus and inferior parietal lobule. M. Allen Starr (Brain, July, '89).

Case of word-blindness with agraphia, due to a spot of softening as large as a five-franc piece, occupying the whole of the inferior parietal lobe. Neither motor aphasia nor word-deafness was present. Sérieux (Bull. de la Soc. de Méd. Mentale de Belgique, Mar., '92).

Case of alexia, agraphia, amnesic aphasia, and word-deafness, due to tumor in the occipital lobe, having largely destroyed the subcortical commissural fibres in the angular gyrus. Weissenburg (Archives de Neurol., July, '92).

Case of pure word-blindness for letters, words, musical signs, with retained ability to read figures and calculate. No word-deafness nor difficulty in articulation nor any impairment of motor power or sensation. Four years later sudden seizure and death. For two days before death there were paraphasia and agraphia resulting from the seizure, which was found at the autopsy to have in-

volved the left inferior parietal convolution and angular gyrus. Old yellowish areas of softening with atrophy found in the lingual and fusiform lobules, the cuneus, and the apex of the occipital lobe; secondary degeneration in the splenium of the corpus callosum; and pronounced atrophy in the optic radiations. The right hemisphere was intact. Histologically, lesion least pronounced at level of lower lip of calcarine fissure and especially localized in the fusiform and lingual lobules, the tapitum, and the radiations of Gratiolet, and the inferior longitudinal fasciculus of Burdach were entirely destroyed. All of the structures in the descending branch of the calcarine fissures were involved in the softening. Conclusion that the lower portion of the inferior longitudinal fasciculus of Burdach contains fibres that connect the visual centre with the centre for language. Dêjerine and Vialet (Comptes Rendus Heb. des Séances et Mémoires de la Soc. de Biol., No. 28, p. 790, '93).

Review of the literature of sensory aphasia, and several cases. Conclusion that the essential central lesion which produces word-blindness is the angular gyrus, there being but little evidence tending to show that the supramarginal gyrus has anything to do with this phenomenon. Shaw (Brain, Winter, '93).

Hemianopsia and word-blindness are not necessarily associated. The frequent association of word-blindness with hemianopsia is explained by the intimate relations existing between the supramarginal convolution and the bundle of optic radiations. In order to explain the absence of word-blindness in right lateral hemianopsia it is necessary to call attention to the intrahemispheric fibres of the corpus callosum; these latter are injured in subcortical alexia, or pure word-blindness. In order to obtain word-blindness without hemianopsia, there must be a lesion of the supramarginal convolution superficial enough to avoid injuring the underlying white fasciculi. Absence of hemianopsia in word-blindness or total aphasia affords a much more favorable prognosis. Joanny Roux (Revue des Sci. Méd. en France et à l'Etranger, Apr. 15, '96).

Prognosis. — Word-deafness may continue permanently, but it frequently improves through the co-operation of other sensory centres, and especially the visual centre. The patient, noting the movements of the lips in those who are speaking to him, recalls motor images which articulation of the same words would require in him.

Word-blindness does not improve in some cases; in others a painstaking and early re-education may be carried out by which new images may be created in the visual memory by the help of the motor and auditory memories.

Aphasia proper, or aphemia, occasionally remains the same from the beginning to the end, no improvement being visible; usually, however, words return very gradually. Recovery, in such cases, is never complete.

Some cases recover almost immediately. This almost always occurs in cases of complete aphasia, and would seem to be of dynamic origin, like the mutism of hysteria or of terrified persons.

Case with agraphia, but without alexia, of eight years' standing. During an attack of anger a sudden pain was felt in the head, and this was followed by recovery of speech. Dobie (Lancet, Jan. 9, '92).

In cortical motor aphasia the patient recovers the faculty of reading gradually in the following order: (1) appearance of the word; (2) association of syllables; (3) association of letters forming each syllable. Exact reverse of learning to read during childhood. Thomas and J. C. Roux (Le Bull. Méd., July 10, '95).

Systematic recovery occurs in cases in which the centres of speech are shocked, but not destroyed, by cerebral lesions which cause aphasia, and which gradually resume their functional activity. A. Pitres (Rev. de Méd., Nov. 10, '95).

If congenital aphasia is found in a child under three years, especially if it be rickety or hydrocephalic, the disorder

may be due to a simple retardation of development; if the patient is more than three years old the prognosis must be very guarded. Herzen (Revue Méd. de la Suisse Rom., Nov. 20, '95).

Agraphia is, in some cases, recovered from in the sense that the patient learns to write with the left hand. The writing does not resemble that performed with the right hand, and in some cases it is written from right to left, as in mirror-writing.

Three cases treated by practice in writing with the left hand; centromotor, marked improvement in a few months; centrosensory aphasia best treated by loud speech or singing. Gutzmann (Deutsche med.-Zeit., Feb. 8, '94).

Supracortical motor aphasia is less serious than cortical motor aphasia, because the intelligence is less affected, the centre of language itself being intact and only the path of communication being interrupted.

Recovery occurs more frequently than in cortical motor aphasia.

The prognosis depends on the site and nature of the lesion. Incurable lesions may preclude improvement even in the slighter cases of aphasia. Extensive progressive lesions are, of course, worse than circumscribed ones. Hæmorrhage, embolism, thrombosis, include the majority of cases of aphasia. If death does not occur, even the worst disturbances of speech may be recovered from; while, on the other hand, even slight affections of speech may persist throughout the remainder of life. Age is an important factor. Children may learn to speak again even after extensive damage to the speech-centres, whereas small lesions in old people may produce a lasting aphasia. The individual power of learning undoubtedly plays a part in the result. The longer the aphasia has lasted without any tendency to improvement, the worse the prognosis, and this is also the case where the intelligence steadily fails. Karl Bok (Festschr. des Stuttgart. Aerztl. Verein, '97).

Treatment.—When there is no paralysis present mental overwork is a frequent cause of aphasia. Prolonged rest alone secures relief. Any disorder, concomitant or causative, that may be present should receive careful attention. At the same time the patient should be taught to overcome the aphasic symptom; considerable patience is usually required. When the aphasia is associated with right-sided paralysis or convulsions, the treatment of the latter condition by alteratives, potassium iodide or mercury if a syphilitic taint be present, sometimes brings about rapid recovery.

Case combined with amimia, the result of a kick of a horse on left parietal bone. Six weeks later, on examination, the patient was found without fever, pulse normal, appetite good, eyes and ears normal, and no paralysis, except of the fingers of the right hand. Over left parietal bone were three ulcers, the lowest of which was two centimetres over the left ear. It was about three centimetres long, equally wide, bulged out, and showed distinct cerebral pulsation. The cranial vault was depressed about the ulcers. The depressed portions of bone were removed, the corresponding defect being covered with two flaps, after von Bergmann's plastic method. The paralysis of the hand disappeared rapidly, followed by complete restoration of speech on the twenty-second day. Rosenberger (Centralb. f. Chir., No. 25, '90).

Remarkably instructive case of nine years' standing. By educating the right hemisphere, within six weeks acquirement of a vocabulary of over one hundred words and several invaluable short sentences. Kuchler (Präger med. Woch., Oct. 18, '93).

Case of uræmic aphasia. The patient, a man of 56, was suddenly seized with an apoplectic attack; he regained consciousness, but presented aphasia, monoplegia of the right arm, and a systolic murmur at the base of the heart. Some days later the patient was seized with a sudden attack of intense dyspnœa, with Cheyne-Stokes respiration; the urine

was scant and very albuminous, and the blood contained seventy-five centigrammes of urea to the litre. The patient was bled immediately and recovered in two days, the monoplegia and the aphasia completely disappearing. Rendu (Gaz. Méd. de Paris, Apr. 4, '96).

Case of complete agraphia and almost complete word-blindness, with right-sided bilateral temporal hemianopsia, due to a lesion (gumma) in the region of the left angular gyrus, in which rapid and complete disappearance of all the symptoms took place under the administration of large doses of iodide of potassium. Byrom Bramwell (Lancet, Mar. 20, '97).

The treatment of amnesic aphasia lies in efforts to stimulate the defective recollection of words. The words must be learned by heart, and then short reading exercises adopted. The exercises should be performed in front of a mirror, in order to restore the recollection of the necessary movements. In motor aphasia other parts of the brain may take on function. Single sounds, then syllables, and lastly words are taught. Writing exercises with the left hand should be performed along with the articulation exercises. The patient should be taught to form words from printed letters. The treatment of sensory aphasia is more difficult. The first attempts are made by means of written language. Lip-reading should be developed, and reading, writing, and other exercises combined with it. The case may be much complicated by a combination of different forms of aphasia. Much patience is required. Karl Bok (Festschr. des Stuttgart. Aerztl. Verein, '97).

Injury to the skull, especially when there is depression of the inner plate, tumors, cerebral hæmorrhage, and other conditions capable of inducing cerebral pressure require appropriate surgical procedures.

Case combined with paraphasia greatly benefited by trephining. Fogliano (Gaz. deg. Osp., No. 4, '91).

Cases illustrating the value of operative measures:—

Case of mind- and word- deafness after repressed fracture of the skull with subcortical hæmorrhage; operation; complete recovery.

Case of glioma of the left centrum ovale, monoplegia, word-blindness, alexia, agraphia, partial apraxia, and color-blindness; operation; improvement.

Case of cyst of the brain in the foot of the left second frontal convolution; motor agraphia (?) from inability to spell; evacuation of the cyst; improvement; traumatic meningeal hæmorrhage two months later; second operation; recovery.

Case of oro-lingual paralysis and slight motor disturbance in writing of thrombotic origin; operation; recovery.

Case of motor and sensory aphasia of seven years' duration, due to probable thrombosis followed by angioma; operation; relief of pain; slight improvement in speech. J. T. Eskridge, Clayton Parkhill, and E. J. A. Rogers (Med. News, June 20; July 11; Aug. 1, 15; Sept. 5, '96).

Wm. Broaddus Pritchard,
New York.

APIOL. — Obtained from the volatile oil of parsley, and at low temperatures, is a stearopten or camphoraceous solid made up of needle-like crystals; but at higher temperatures resolves itself into a yellow or straw-colored liquid. It has a slightly-acid reaction and is soluble in alcohol, ether, and chloroform. Most of the apiol of commerce is nothing but an oil of parsley, though the best has usually a percentage of the latter added in order to insure fluidity at all temperatures. It may be prepared in various ways, but the methods of manufacturers as published are usually obscure, and often open to severe criticism. So-called *green* apiol is the oil of parsley loaded with chlorophyl and vegetable fats. The *red* apiol that appears in the market, as well as the proprietary so-called "apioline," is merely the yellow apiol oxidized by means of sulphuric acid.

Dose.—Owing to unpleasant odor and acrid taste, apiol is best administered in gelatin capsules or perles, each holding from 3 to 5 grains. Two to four capsules may be taken daily, preferably night and morning, beginning two or three days before the expected menstrual flow.

Physiological Action. — Apiol is thought to mainly act upon the vascular system, causing congestion, and at the same time on the muscular tissue of the uterus. This view is based upon its action as an emmenagogue and by its effects upon the menstrual flow; yet it is also a regulator of uterine function.

Therapeutics. — According to Griffith and Cerna, apiol (apioline) may be regarded as the best emmenagogue at present known. It is indicated in amenorrhœa due to anæmia from whatever cause. W. A. Newman Dorland believes, however, that, in order to insure the best results, it should be combined with some preparation of iron; he also suggests that iron be given uninterruptedly until a few days before the expected appearance of the menses. Then, continuing the iron, apiol may be prescribed in 5-minim doses, two or three times a day, until the appearance of the menstrual discharge.

Apiol (apioline) strongly recommended for the relief of dysmenorrhœa and amenorrhœa. Hill (Virginia Med. Monthly, Apr., '91); Delmis (Le Prog. Méd., Apr. 25, '91).

In the treatment of dysmenorrhœal cases, where there is no tangible pelvic lesion demanding strictly local attention, or operative interference, I have of late come to rely on a single remedy: apiol, the active principle of *Petroselinum sativum*. Three illustrative cases of the neurotic variety of dysmenorrhœa, demonstrating the marked value of the drug as a therapeutic agent, D. S. Maddox (Med. and Surg. Reporter, June 5, '97).

APOCODEINE. See Opium.

APOCYNUM CANNABINUM. — This is the root of the *Apocynum Cannabinum*, or Canadian hemp. The plant is gray or brownish gray in color, with rather thick bark and porous spongy wood. It contains, besides tannic acid, gallic acid, and gum resin, a bitter principle which is found in the market under the name of "apocynin." This is an amorphous resinous substance, not a glucoside, easily soluble in alcohol and ether, and almost insoluble in water.

Apocynum itself is inodorous, and has a disagreeable, bitter taste.

Dose. — The powdered root may be given in doses varying from 5 to 30 grains. In small doses it acts as a bitter tonic; in 10- to 15-grain doses it acts as a diaphoretic, diuretic, and laxative. In larger doses—15 to 30 grains—it very considerably irritates the gastro-intestinal tract and gives rise to vomiting and diarrhœa.

Dose of the decoction (1 drachm to 8 ounces), 1 $^1/_2$ to 2 ounces daily; of the tincture (1 part to 10), 5 to 10 minims. The U. S. P. fluid extract, in doses of from 10 to 30 minims, is a valuable preparation.

Physiological Action.—Apocynum produces a very pronounced retardation of the pulse, with a very considerable enlargement of the pulse-wave and a marked rise of the blood-tension. The initial retardation of the heart is followed by an acceleration of the cardiac action, while the arterial pressure ascends still farther. The cardiac retardation (first stage) is caused by an irritating action of the drug, both on the central and peripheral inhibitory apparatuses. The subsequent acceleration (second stage) is not dependent upon anything like paralysis of the inhibitory

apparatus, since the injection of another dose of the infusion can again give rise to a retardation of the heart's work.

On the injection of a very large dose the two stages are followed by a third one, which is characterized by cardiac arhythmia, the appearance of Traube's waves, and a gradual fall of the blood-pressure down to 0. The rise of the blood-tension during the first and second stages is dependent not only upon the stimulation of the vasomotor centres in the medulla oblongata, but also (and that in a very considerable degree) upon the excitation of the spinal vasomotor centres. Moreover, the heart and blood-vessels themselves take a certain active part in the causation of the rise. Both the central and peripheral vasodilatory apparatuses remain wholly intact. (Sokaloff.)

> Its effects are very similar to those of digitalis. It slows the pulse and increases blood-pressure, the latter effect being due to stimulation of the heart or of the vasomotor mechanism, or both. It stimulates the heart-muscle directly, and, like digitalis, it causes a cessation of cardiac action through overstimulation. There is probably also an action upon the arterial walls. Studies show that the kidney circulation is diminished, due to a narrowing of the lumen of the vessels of the organ. The diuretic action of the drug is a consequence of the regulation of the circulation. The slowing of the pulse is caused by stimulation of the cardiac inhibitory centres. Like digitalis, apocynum is likely to disturb the stomach. It is possible that this effect is due to a different substance from that which causes the stimulation, and if the active principles were isolated we should have an exceedingly valuable drug. Horatio C. Wood, Jr. (Therap. Review, No. 3, p. 86, 1904).

Therapeutics.—The action of the root of the *Apocynum Cannabinum* is similar to that of digitalis, without being cumulative.

Cardiac Affections. — In cases of cardiac dilatation the fluid extract rapidly diminishes the area of dullness. In cases of mitral and aortic insufficiency, with disturbed compensation, it is also valuable.

> Seven cases of mitral and aortic insufficiency with disturbed compensation in which the fluid extract of apocynum, 15 drops three times a day, was used. Great improvement noticed within three days. The cardiac impulse grew stronger, the pulse became more regular, fuller, and slower, its frequency in some instances decreasing from 130 or 120 to 56 or even 48 per minute, in 48 hours. The blood-pressure rose; cyanosis and pulsation of the cervical vessels vanished; the area of cardiac dullness decreased; the daily quantity of urine increased (in one case it rose from 450 cubic centimetres to 2800 cubic centimetres); the body-weight fell, the diminution varying from thirteen to twenty-one Russian pounds. No unpleasant accessory effects from the drug noticed. Grozdinsky (Wratsch, No. 19, '96).

Dropsy. — The main usefulness of apocynum, especially when the fluid extract is employed in doses of 7 to 8 drops, is in the treatment of dropsies. Such a dose, repeated at short intervals if necessary, causes copious watery discharges from the bowels, the flow of urine being increased. As tolerance is established by continued use, it is necessary to increase the dose when given for a long time. (Richmond.)

It is also possessed of diaphoretic powers, which exert an effect upon the dropsy.

> Apocynum properly administered is a very remarkable diuretic. Doubtless it acts indirectly by increasing the arterial pressure, but it must also be a direct renal stimulant, and cause dilatation of the renal arterioles. So far as I know, this has not been demonstrated, but the effects point to such a mode of action.

Its influence is best seen in those general effusions that depend upon a want of vascular tone, and, whatever the reason, the empirical fact remains that most remarkable results have followed its use. A. A. Woodhull (Brit. Med. Jour., Dec. 11, '97).

Violent catharsis and emesis follow its abuse and not its intelligent use, and it is a really trustworthy and singularly efficacious hydragogue, especially in anasarca. The true value of properly administered apocynum is as a diuretic. It doubtless acts indirectly by increasing the arterial pressure, but it must also be a direct renal stimulant, and cause dilatation of the renal arterioles. A. A. Woodhull (Brit. Med. Jour., Dec. 11, '97).

To assist in removing the solid œdema which often prevents the healing of varicose ulcers in the aged, apocynum has proved more useful than any other drug. F. R. Millard (Med. and Surg. Reporter, Apr. 16, '98).

Apocynum is excellent in cardiac dropsy if a good preparation is employed. Large doses are apt to disagree, and small ones are preferable for diuretic action. One of its active principles—apocynin—appears to resemble digitalin in its effect upon the heart; so that the diuresis produced is evidently cardiovascular in character, and it practically represents the diuretic principle of the drug. Apocynum causes no cumulative effects, and it will occasionally prove efficient in removing dropsical symptoms of cardiac insufficiency. T. B. McGee (Amer. Therapist, No. 10, 1900).

APOMORPHINE.—Apomorphine is a pseudo-alkaloid obtained by the action of HCl on morphine in sealed tubes at a high temperature. The base can be obtained from the resulting hydrochlorate of morphine by dissolving in water, adding excess of bicarbonate of soda, and extracting by means of ether or chloroform. It is soluble in hot or cold water and in alcohol. In powder it is white; but a watery solution, though at first colorless, soon turns black.

The salt generally employed, however, is the hydrochloride: made by adding a small quantity of hydrochloric acid to a solution of apomorphine. It occurs in grayish-white crystals, which are odorless and slightly bitter. It becomes green on exposure to light and air.

Dose. — For adults $^1/_{15}$ to $^1/_5$ grain. Great care must be observed in using it in feeble persons. Death has been caused by $^1/_{15}$ grain under such circumstances. For a child of 18 months, $^1/_{50}$ grain; 2 years, $^1/_{40}$ grain; 3 years, $^1/_{35}$ grain; 5 years, $^1/_{30}$ grain; 8 years, $^1/_{25}$ grain. One-fifth of a grain should not be surpassed in any case when given hypodermically, and $^1/_4$ grain when administered by the mouth.

The drug acts with more vigor in some individuals than in others. Its effects, therefore, should be watched.

Case of a drunkard in whom $^1/_{10}$ grain of apomorphine, hypodermically administered, followed in five minutes by another $^1/_{40}$ grain, caused collapse, unconsciousness, cold surface, and absence of pulse at the wrist. Westby (Brit. Med. Jour., Feb. 2, '89).

When administered on an empty stomach, apomorphine produces vomiting much more readily than when administered after meals. The rate of absorption has much to do with the entire effect. When given hypodermically, it is absorbed at once; when given on an empty stomach, it is absorbed more rapidly than when mixed with foods. Murrell (Brit. Med. Jour., Feb. 28, '91).

A very important fact is the great tendency to decomposition shown by apomorphine hydrochloride on exposure to moisture or moist air. As it is also affected by light, it should always be kept in amber-colored bottles. Again, it should never be kept in solution, the latter being always made fresh when it is to be used. Serious symptoms have

followed neglect to heed this precautionary measure.

Its purity may be tested by shaking up in a test-tube a 1-per-cent. solution. If the latter turns emerald-green, it should not be employed. (U. S. P.)

Physiological Action. — The physiological action of apomorphine as an emetic may be gathered from its symptomatology, which is as follows: The administration of $^1/_{10}$ grain hypodermically is followed in scarcely one-half minute by fullness of the head; the pulse is quickened and increased in volume; the pupils slowly dilate; the face is flushed. Perspiration soon appears; the respiration become more frequent and the heart-beats more rapid; and before two minutes elapse emesis is produced. Then comes the reaction, a general relaxation, lasting about an hour. The eyes are sunken, the pupils are widely dilated, and the face is pallid and drawn. Yawning inaugurates the period of recovery; sleep follows and upon awakening all effects have passed away. (W. D. Carter.)

These effects indicate that the physiological action of apomorphine must be multiple. This has been found to be the case in experiments upon animals. The drug seems first to excite the cerebral centres, then to depress them. The peripheral arteries become prominent and tense, indicating arterial tension, due to increased rapidity and force of cardiac action.

It is primarily a stimulant and finally a paralyzant. In excessive doses it causes convulsions, but in a manner not yet fully understood.

Therapeutic doses have no appreciable effect aside from acceleration of the pulse-rate, the maximum being reached about the time vomiting begins. This is due to stimulation of the accelerator mechanism. Following vomiting the pulse-rate decreases: the probable result of depression of the heart-muscle, since it has been shown that apomorphine is a muscle-poison.

The respirations are usually increased, though variably so, after decided doses. In case of lethal dose respirations cease as a result of paralysis of the controlling centres.

Apomorphine has very slight, if any, influence upon temperature.

Apomorphine Poisoning.—When poisonous doses are given to animals, the opposite of the above is the case; depression of cardiac action first occurs, followed by weakness and rapid pulse.

The drug also acts as a convulsant through its influence upon the spinal cord, the convulsions being accompanied or followed by muscular paralysis. The respiratory centres are also deeply involved and death occurs from respiratory paralysis.

In the human being toxic doses of apomorphine produce collapse, unconsciousness, failing circulation and respiration, and all the symptoms of profound depression of the vital centres. Convulsions usually precede the profound depression, and vomiting rarely occurs.

Treatment of Poisoning. — The antidotes are strychnine, chloral, and chloroform. These should be supplemented by the more diffusible stimulants, as ammonia, whisky, coffee, etc., together with external heat.

Therapeutics.—Apomorphine is doubtless the most reliable of our emetics and the one which acts most rapidly, but the effects obtained depend greatly upon the quality of the drug used. Untoward effects of various kinds have been reported, including, besides those added to the normal action of apomorphine, marked depression. This latter has occasioned

a certain amount of distrust on the part of the profession, which, however, has no reasonable basis, provided a pure drug can be obtained, and proper precautions are taken, the most important of which is to prepare the solution at the very moment it is to be administered.

The value of apomorphine—according to Carmichel, who voices the experience of pediatricians who have used the remedy extensively—cannot be too highly esteemed as an emetic for children; the average time at which emesis occurs is much less than the period required by the yellow sulphate of mercury. It affords prompt relief in croup and capillary bronchitis without being attended by nausea and violent retching, which makes it a great boon to children.

> Apomorphine used after antitoxin injections in laryngeal diphtheria when the swelling and softening of the false membrane cause signs of suffocation. A hypodermic dose of $^1/_{12}$ grain induces vomiting and clears the larynx. Arnstein (Med. News, Apr. 8, '99).

It is an expectorant, in doses ranging from $^1/_{80}$ to $^1/_{20}$ grain. As such it affords great relief in cases of bronchitis, tracheitis, and catarrhal pneumonia.

A spray of apomorphine in weak solution is sometimes recommended, but its use in this manner is hardly safe. It has been found valuable in whooping-cough to relax spasmodic attacks. (Ingram.)

It has recently received much praise as a soporific—especially in acute alcoholism.

> Apomorphine as an hypnotic found equally useful in all forms of insomnia regardless of the cause. It should be given in a single dose of about $^1/_{30}$ grain, injected subcutaneously. The object is to give a dose that, on the one hand, is large enough to produce sleep, and, on the other, is so small that nausea and vomiting are avoided. Hence, individual susceptibility must be considered. It should be given when the patient is in bed, for its effect is very rapid and the patient will usually fall into a restful sleep within five to twenty-five minutes. If no results are observed within one-half hour the dose is too small. The effect persists for from one to two hours, but in many cases of insomnia the patient will sleep all night. C. J. Douglas (N. Y. Med. Jour., Mar. 17, 1900).
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> To obtain an hypnotic action in alcoholic patients with apomorphine it should be given hypodermically. It is best to begin with a small dose—$^1/_{30}$ grain or less—and to repeat this or give a slightly larger dose within a short time. Further doses should not be given after vomiting occurs, until several hours have passed. Doses repeated in two or three hours have but little beneficial effect. They should not be repeated in patients who are weak. The duration of the hypnotic action is only a few hours, and when the patient awakes his condition is practically unchanged, except in "ordinary drunks." The best results are obtained from apomorphine when it is followed in two or three hours by some recognized hypnotic, as bromide, chloral, paraldehyde, etc. Solutions of apomorphine are unstable, and should be freshly made for use. Old solutions should never be used.
>
> The administration of apomorphine to patients in delirium tremens is without beneficial result, and may even be attended with danger from its depressing action. Experience based on its use in three hundred alcoholic patients. Warren Coleman and J. M. Polk (Amer. Med., vol. iii, No. 10, 1902).

Bronchitis.—Murrell recommends that apomorphine be given in large doses as an expectorant in this disease: $^1/_2$ to $1\,^3/_4$ grains. He also obtained excellent results from an ointment of: apomorphine, 1 grain; lard or lanolin, 1 ounce; the half of which is rubbed into the chest: a point of very great practical importance, especially in the treatment of children. Murrell also ob-

served the expectorant effect in many by using the apomorphine as a spray. It was very marked when the drug was used in large doses, and a dose which would act as an emetic, if administered hypodermically, can be used as an inhalation without giving rise to this result.

CROUP.—In croup, where the case is urgent or where an expectorant effect is desired, $^1/_{100}$ or $^1/_{60}$ grain every fifteen minutes gives the happiest effect. As relief comes, the time of dosing is extended to one or two hours, but the minimum dose is continued. When it is desirable to evacuate the stomach promptly, no remedy meets the case better than apomorphine. Cardiac depression following the use of the remedy should be promptly met by suitable stimulants and tonics.

GASTRALGIA.—From the fact that it produces emesis by its action through the spinal nerve-centres, and not by irritation of the mucous membrane, it is a preferable remedy in inflammatory conditions of the stomach where emetics are indicated.

> Case of indigestion and violent gastralgia in which apomorphine was given hypodermically to produce emesis. Within two minutes the patient was entirely free from pain, fell asleep and slept for an hour, and was perfectly comfortable afterward. S. F. Morris (N. Y. Med. Jour., Nov. 10, '94).

POISONING. — The value of apomorphine as an antispasmodic is attested by Edward Balm, of Hyderabad, who tried it in a distressing case of hiccough in a man, 50 years old, who had suffered from the affection for about six months. It is thus shown to be doubly valuable as an emetic in cases of poisoning from the ingestion of such drugs as strychnine, that cause tetanic manifestations, although after poisonous doses of drugs such as chloral—in which the symptoms are quite the opposite—it is equally useful.

> Case in which recovery followed after a large dose of chloral. The patient, a young man, had taken suicidally 3 ounces of syrup of chloral (B. P.). He was found in the morning unconscious, with cold, clammy, and livid body; stertorous respiration; small and quick pulse, and dilated pupils. The treatment consisted of an hypodermic injection of $^1/_{10}$ grain of apomorphine, which was followed immediately by profuse vomiting; the injection of a pint of hot, strong coffee; heaters, and flagellation. After two hours of treatment the patient could speak and swallow hot coffee. He continued to improve, and in twelve hours more, though somewhat dazed, had practically recovered. Holburton (Brit. Med. Jour., Nov. 12, '92).
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> Case of attempted suicide by strychnine in which the patient had swallowed a pill containing $1\,^3/_4$ grains of the drug. Apomorphine, cutaneous frictions, cold douches, chloral-hydrate, and bromide of potassium brought about recovery. J. Augustin and P. Flor (Spitalul, Nos. 11, 12, '94).

In very severe cases it may be necessary to administer $^1/_{10}$ grain every ten minutes until some effect is obtained, or exhibit $^1/_4$ grain at a single injection. In feeble persons and in children great caution must be exercised.

> Case of strychnine poisoning in which apomorphine, in doses of $^1/_{15}$ to $^1/_{10}$ grain, subcutaneously injected, completely subdued the convulsions, and, eventually, successfully antagonized the excitant alkaloid. Horsley (Canadian Practitioner, Dec. 6, '90).
>
> Case of a man who took a large dose of bromidia and became violently insane, requiring three men to control him. Soon after receiving $^1/_{10}$ grain of apomorphine he vomited, had a movement of the bowels, his mental condition was relieved, and he slept well the remainder of the night. Ingram (Southern Med. Record, Apr., '92).

HYSTERICAL CRISES. — Apomorphine has been employed in a large number of

minor hysterical phenomena, in which the remedy gave prompt relief. The amounts used varied from $^1/_8$ to $^1/_{20}$ grain, hypodermically administered, and were never followed by any alarming symptoms. (Horsley.)

APOPLEXY. See CEREBRAL HÆMORRHAGE.

APPENDICITIS (from Latin, *appendere*, to hang on; and *itis*, inflammation).

Definition. — An inflammation of the vermiform appendix, frequently complicated with ulceration and perforation of its coats, caused by microbic infection, which may originate from irritation produced by hardened fæcal masses, foreign bodies, or traumatism.

Symptoms. — Whether catarrhal or ulcerative, the attack presents itself usually in a previously healthy person and begins with sudden intense pain in the right iliac fossa, frequently localized at a spot one and one-half to two inches from the anterior superior spine of the ileum toward the umbilicus (McBurney's point), and increased by pressure. This is the most important diagnostic sign when associated with the other symptoms. The pain may radiate from this point toward the umbilicus, the epigastrium, the groin, and the testicles, and be attended by exacerbations. It may be felt in other parts, especially the epigastrium and the umbilicus, and may even be located in the left iliac fossa.

> One of the most significant symptoms of inflammation of the appendix, as distinguished from other pathological conditions that may develop in the right iliac fossa, is undoubtedly the tenderness over McBurney's point. Too often it is assumed by the practitioner that there must be spontaneous pain in the right iliac fossa whenever acute appendicitis develops. It is perfectly possible, however, for an active inflammation of the appendix to be dangerously progressive without the slightest pain in this region, or with only some passing discomfort on movement. Yet a touch over the point midway between the anterior superior spine and the umbilicus may reveal the existence of exquisite tenderness. This is the significant value of the diagnostic symptom discovered by the New York surgeon, and the real reason why McBurney's point has attracted the attention of the medical world. Editorial (Jour. Amer. Med. Assoc., Aug. 16, 1902).

> Absence of pain is no indication that the most serious mischief is not going on. The initial pain of acute inflammation of the appendix, which is so commonly referred to the umbilicus, is due to the peristaltic action of the cæcum or of the appendix dragging upon the attachment of the peritoneum to the abdominal wall. The cessation of this umbilical pain without improvement in the other symptoms is due to cessation of the peristalsis caused by the inflammation having spread to the muscular coats of the bowel. The development of local pain, which usually precedes the cessation of the umbilical pain, means that the inflammation has spread from the appendix to the parietal peritoneum or to the post-peritoneal cellular tissue. Severe pain is of serious import, as it implies either wide extent or great severity of inflammation. Moullin (Lancet, Aug. 22, 1903).

Nausea and vomiting are present in the majority of cases, but it does not furnish any information as to the seriousness of the case.

> Vomiting present in 208 out of a series of 306 cases; it bodes neither good nor ill. Hood (Lancet, Sept. 18, '97).

The pulse is usually high, but the temperature-chart shows but little, if any, rise.

> The most important point to bear in mind in the diagnosis of appendicitis is the fact that the temperature of the patient is a matter of no consequence as giving any clue to the condition of the appendix. R. T. Morris (Med. Record, Dec. 26, '96).

Anorexia and digestive disorders are rarely absent. Diarrhœa and constipation alternate, but either symptom may be a prominent one during the entire course of the attack.

Rigidity of the right abdominal wall is generally present, but circumscribed rigidity over the region of the appendix is present in about one-half of the cases.

Circumscribed muscle-tension was observed one hundred and twenty times in three hundred cases. Shrady (N. Y. Med. Record, June 6, '94).

If the case be one of simple catarrhal appendicitis, the above symptoms continue two or three days and the patient gradually recovers.

Leucocytosis has recently been suggested as an important sign.

Method of differential diagnosis more accurate than the ordinary clinical methods available, viz.: examination of the blood. In appendicitis with pus-formation there exists a typical abscess, and in abscess-formation there is an increase in the number of leucocytes, the increase being proportionate to the amount of pus-formation. If there is no leucocytosis, the case is either not one of appendicitis or one of the catarrhal form, and extremely mild, or very severe and gangrenous, the patient being in a moribund condition. This means of diagnosis and prognosis should be given a trial. H. Stuart MacLean (Virginia Med. Semi-monthly, Sept. 22, '99).

In the diagnosis of suppurative appendicitis the white blood-count is of the greatest importance. A sudden hyperleucocytosis points to a complication in an infectious fever,—typhoid, for instance,—and if sudden abdominal pain appear an exploratory incision is warranted, as is the practice in the Johns Hopkins Hospital. Hyperleucocytosis at once differentiates a suppurative appendicitis from simple colitis, typhoid fever, ovarian neuralgia, impaction of fæces, and floating kidney. By a blood-count pus can be detected within twenty-four hours, and an unfavorable prognosis converted into a very favorable one. Robbin (Med. Record, Oct. 27, 1900).

Examination of seventy cases sustains the opinion of observers in regard to the value of the leucocyte count in differentiating simple fibrinous exudate from abscess formation. In the former there may be in the beginning a leucocytosis of 23,000, but it rapidly subsides. If the number of leucocytes remains continuously high or reaches or surpasses 25,000 later in the affection, an abscess may be assumed or retention of pus. In case of diffuse peritonitis the height of the figure is not so characteristic as its tendency to rise or fall. Stadler (Mittheilungen a. d. Grenzgebieten der Med. u. Chir., vol. xi, No. 3, 1903).

Variations from the above course are occasionally met with. The disease may come on insidiously and fever or pain be totally absent. Although such an onset is occasionally met with in adults, it is most likely to occur in children. Occasional colicky pains are sometimes the only early signs furnished, these being followed by the typical symptoms described above. Slight appendicular lesions may be accompanied by alarming symptoms in hysterical patients, or in those mentally and physically below par.

The majority of errors in the diagnosis of intra-abdominal inflammations consist in mistaking atypical forms for other morbid conditions. List of 11 cases in which the mistake of regarding as appendicitis conditions which, upon operation or necropsy, proved to be other and unsuspected pathological processes. In 2 renal calculus, in 4 diseases of the uterine appendages, in 1 sarcoma of the ileum, in 1 cholecystitis, in 1 acute suppurative pancreatitis, and in 2 to general sepsis. Brewer (Annals of Surg., May, 1901).

Cutaneous hyperalgesia is probably present at some time during all first attacks of appendicitis, except perhaps in the fulminating type, and depends upon tension within the appendix. It may be absent in attacks after the first.

if the first attack was of sufficient severity to destroy nerve-tissue in the wall of the appendix. When present in attacks subsequent to the first it often persists long after all other signs of the disease have gone, owing to the tension within the appendix being kept up by the presence of a stricture. It gradually disappears during convalescence as the other signs of the disease clear up. Disappearance of cutaneous hyperalgesia without improvement in the general condition of the patient is a sign of perforation or gangrene of the appendix, and should be a signal for immediate operation. The presence of cutaneous hyperalgesia is no contra-indication to operation. Abscesses may form and general peritonitis may develop while it is present. Its absence, on the other hand, is of great importance. Absence of cutaneous hyperalgesia, the patient coming under observation early in the first attack of appendicitis, is a sign of gangrene of the appendix unless the case is obviously a mild one and the patient is rapidly getting well. Cutaneous hyperalgesia is, as a rule, absent in cases of abscess of the appendix. The age of the patient and the position of the appendix have no influence upon the cutaneous hyperalgesia. It is occasionally of use as an aid to the diagnosis of appendicitis. J. Sherren (Lancet, Sept. 19, 1903).

Progress toward simple perforation or perforation into a cavity bound by adhesions is probable, when on the third day after the onset of the symptoms there is localized superficial œdema, indicating deep suppuration, and when a doughy mass is felt at the seat of pain, which mass gradually assumes shape to the touch, unless distended intestinal coils, shown by local tympanites, or the tension of the abdominal walls makes its detection impossible.

In three hundred cases the tumor in the right iliac fossa rarely showed itself before the third day of pain and tenderness. A tumor may, however, be due to accumulation of fæces in the cæcum. Dullness on percussion is rarely recognized before the fourth day. G. F. Shrady (N. Y. Med. Record, Jan. 6, '94).

Fluctuation does not generally occur until the second week. Œdema of the overlying integument does not occur until a paratyphlitic abscess has formed. G. F. Shrady (N. Y. Med. Record, Jan. 6, '94).

Diagnosis is made almost certain by the presence of a bunch, usually situated in the right lower quadrant of the abdomen or near the liver or left side. It may be obscured by abdominal distension or muscular rigidity. Gay (Boston Med. and Surg. Jour., Jan. 3, '95).

The presence of slight œdema over the loin is an indication of the presence of deep-seated suppuration. Symonds (Brit. Med. Jour., Jan. 26, '95).

According to Lewin, the local application of heat will show whether an inflammatory process has progressed to suppuration or not. In appendicitis, if pus has not formed, the application of heat will be a comfort to the patient. If pus is present, the pain will increase in severity. Eight of 10 cases in which heat was applied for two hours by hot compresses experienced marked relief, while in the other 2 there was increase of pain. These 2 died from extension of the suppuration. Spohr has had a similar experience in 15 cases. Editorial (Therap. Gaz., May 15, 1901).

If suppuration is present and perforation occurs on the fourth or fifth day,—*i.e.*, after the adhesions have formed,—the symptoms do not, as a rule, vary from those enumerated. When, however, they do not assume a graver form during the first four days, the presence of protective adhesions is likely.

Danger may exist without being shown by pulse or temperature. Pulse, temperature, and pain may decline, marking the occurrence of effusion: a deceptive calm. The sudden access of intense localized pain indicates a dangerous change in the local conditions. G. F. Shrady (N. Y. Med. Record, Jan. 6, '94).

Too much stress must not be laid on the temperature, as recovery may follow

a temperature of 105° F. and death may occur with one nearly normal. Richardson (Amer. Jour. Med. Sci., Jan., '94).

When the symptoms are marked and a tumor cannot be felt, perforation has probably occurred before the adhesions were sufficiently perfect to protect the peritoneal cavity.

If perforation has occurred early,—*i.e.*, while the adhesions were still imperfect, — there is usually a chill and vomiting; shock, more or less profound; diffuse, marked pain, instead of the localized pain; acceleration of the pulse; an increase of temperature of 2° or 3° F.; scanty and dark urine, showing high specific gravity.

The cause of diffuse peritonitis complicating appendicitis, ascertained by personal clinical observations, is as follows: 1. Peristaltic motion of the small intestines is the chief means of carrying the infection from the perforated or gangrenous appendix to the other portions of the peritoneum, changing a circumscribed into a general peritonitis. 2. This can be prevented by prohibiting the use of every kind of food and cathartics by mouth, and by employing gastric lavage in every case in which there are remnants of food in the stomach or in the intestines above the ileocæcal valve, as indicated by the presence of nausea, vomiting, or meteorism. 3. The patient can be supported by the use of concentrated predigested food administered as enemata not oftener than once in four hours, and not in larger quantities than 4 ounces at a time. 4. This form of treatment, when instituted early, will change the most violent and dangerous form of acute perforative or gangrenous appendicitis into a comparatively mild and harmless form. A. J. Ochsner (Amer. Surg. and Gynæc., Jan., 1902).

Perforation is also accompanied by distension of the abdomen, and symptoms of grave diffuse peritonitis appear, followed by collapse. Dullness affords an early clue to the presence of pus.

Distension of the abdomen depends, for its importance, upon its cause. Opium may cause it or gas may form. If peristalsis is not inhibited no alarm need be felt. Distension due to local infection is of the gravest import. Richardson (Amer. Jour. Med. Sciences, Jan., '94).

General abdominal distension is the most dangerous symptom. Gage (Boston Med. and Surg. Jour., May 24, '94).

A point of marked dullness in cases without any pronounced inflammatory symptoms was always found when the appendix was indurated and adherent to the adjacent tissue. In all of 19 cases in which dullness was present pus was diagnosed. This was verified either by operation or by autopsy, except in 2 cases. H. T. Miller (Med. Record, Feb. 9, 1901).

The actinomycotic form is characterized by slower progress and less acute symptoms.

In the rheumatic form there is much tenderness over the appendix. No tumor or dullness can be detected. Arthritis, however, is present.

The infectious form is distinguished by a rapid course.

When appendicitis occurs during pregnancy, the attack is usually sudden and begins with abdominal pain which gradually becomes localized; this is followed by the typical symptoms. This condition must be carefully differentiated from tubal pregnancy. The prognosis is grave.

Appendicitis complicating pregnancy is difficult of recognition and the cause of great mortality. Hrawacek cites 13 cases of catarrhal appendicitis with pregnancy, 5 cured without operation, 11 operations, and 7 deaths. Case in which abscess associated with a necrosed appendix was removed without disturbing the pregnancy; three months afterward the patient gave birth to a healthy child, having a normal delivery and puerperium. Appendicitis sometimes appears as a complication of diseases of ovaries and appendages. Martin in 171 operations for right-sided salpingitis and 276

double-sided found appendicitis 6 times in connection therewith; Dührssen in one and one-half years, out of 322 laparotomies, had 10 cases of diseased appendix; Ochsner, of Chicago, in 51 operations for primary appendix found 15 times secondary disease of the appendages. Otto Falk (Centralb. f. Gynäk., Feb. 17, 1900).

The writer reports 4 cases of appendicitis complicating pregnancy, and has collected in addition 20 others in the literature of the subject. Of the 24 cases collected, 6 were non-suppurative. These recovered without operation, although the pregnancy was interrupted in several. In 18 suppuration occurred, and of these 9 recovered and 9 died, a mortality of 50 per cent. In only 4 of these was the pregnancy uninterrupted, giving a percentage of 78 in which abortion occurred after the formation of pus. The necessity for immediate operation in these cases is self-evident. Heaton (Brit. Med. Jour., Mar. 4, 1905).

Diagnosis, General. — During examination gentle manipulation is necessary, lest an abscess be present and the adhesions be delicate and unable to stand the traction or pressure. (McBurney.)

The amount of manipulation necessary to make a complete diagnosis should be of the very lightest possible kind. Anything more than very light manipulation in one of these cases must be accompanied by a certain amount of danger, because we do not know the thickness of the barrier between abscess-cavity and the peritoneum. McBurney (Buffalo Med. Jour., June, '96).

The location, direction, and extent of the appendix have an important bearing on the clinical history of appendicitis, considering the variations of the appendix in length, direction, and location, and the varying site of the cæcum.

It is quite possible to feel the normal appendix in most cases. If one palpates gently with two or three fingers on the opposite side one can readily get the landmarks. The ascending colon is the first landmark. Three fingers are placed upon the rectus muscle, then brought down over the edge of the muscle, three fingers of the right hand being used to feel with and the three fingers of the left hand to press with. The examining fingers are pressed by means of the three others down under the border of the right rectus abdominis muscle at the level of the navel, and slowly drawn to the examiner. The landmark, the ascending colon, is then felt to slip out from under the fingers, and, by repeating the process toward the cæcum, one soon comes to the end of the latter, and there begins to hunt for the appendix by rolling the cæcum to one side or the other of the finger-tips. The proximal end of the appendix is found near the distal end of the cæcum; the remainder of the appendix is followed in any direction. The proportion of appendices that cannot be palpated will become smaller as the finger-tips become educated. The very delicate sense of touch is preserved if the left hand is used for pushing upon the examining hand. Robert T. Morris (International Jour. of Surg., Aug., '98).

Auscultation of the lungs and heart sometimes affords information.

Examination through the rectum is of value in determining the presence of pus in advanced cases. In the earlier stages this procedure is of no value.

Examination of the urine may assist in the location of the inflammatory process and in determining the activity of metabolic processes. Glycosuria was also found present in three cases examined by Leidy.

In 228 consecutive cases of appendicitis in which there was an operation there were 7 errors in diagnosis; these include 1 each of old typhoid-fever complications, peritoneal tuberculosis, cancer of appendix, congestion of appendix, hysteria, pneumonia, and sequelæ of measles. As the number of errors is small compared with the total number of cases, it is concluded that appendicitis is one of the most readily diagnosed of all diseases. In 4 of the cases in which an incorrect diagnosis was made the operation was

of benefit to the patient. Robert T. Morris (N. Y. Med. Jour., Apr. 8, '99).

The youngest patient on record operated on was sixty-one days old. Children seem to bear general septic infection better than adults. The two conditions from which infantile appendicitis must be differentiated are intussusception and tuberculous peritonitis. The most reliable source of information lies in the careful examination of the abdominal wall, which, in a child, is very easily accomplished. Abdominal distension, frequent and shallow respiration are common. T. H. Manley (Jour. Amer. Med. Assoc., June 1, 1901).

Every death from appendicitis, in an individual otherwise well, excepting those of the fulminating type, could have been prevented by the use of the knife at the proper time. If one is to operate early, an early diagnosis is necessary. If the three cardinal symptoms of appendicitis are kept in mind, the early diagnosis is, in nine cases out of ten, very simple. The three cardinal symptoms are pain, tenderness, and rigidity. J. B. Deaver (New York Med. Jour., Dec. 7, 1901).

We can best diagnose the locality of the disease by the following method: Ask the patient to point the finger quickly to the spot where there is the most pain without looking at the abdomen. Repeat this proceeding a number of times until you are certain that the right point has been obtained. Then the course of the appendix will lie between the base of the organ and this point. Where no mass can be felt in the region it is impossible correctly to diagnose a perforation or gangrene. Where the mass can be felt and persists longer than two or three days without diminishing in size or indeed even increasing, it always has pus for a nucleus. C. A. Elsberg (Med. Record, April 5, 1902).

There are a certain number of cases in which the diagnosis of appendicitis is so evident that no one questions the propriety of operation. There are other cases in which the symptoms remain permanently, subjecting the patient to frequent exacerbations. There is a third class in which the symptoms abate never to return, on the one hand, or to return at intervals, on the other hand, until relieved or until death occurs. In any case of appendicitis in which the diagnosis is undoubted and the services of a competent surgeon can be secured, operation should be done. James Tyson (Proceedings Amer. Med. Assoc.; Phila. Med. Jour., June 21, 1902).

Diagnosis, Differential.

Intestinal Obstruction. — In this disorder the rise of temperature occurs late. Stercoraceous vomiting is observed in serious cases. Volvulus generally presents itself in children.

Three signs of great value in establishing a differential diagnosis: 1. A "blood-count," leucocytosis up to 40,000 to 50,000 being usual in suppurative appendicitis. 2. Lewin's sign: that heat applied over a focus of suppuration increases the local pain, and would thus increase that of suppurative appendicitis, but rather relieve that of acute obstruction. 3. The difference between the axillary and rectal temperatures. Normally the rectal is 0.6° C. higher than the axillary temperature, but in appendicitis this difference is greatly increased, even to 1.4° C., due to the hyperæmia of the pelvic viscera and especially of the rectum and the recto-vesical *cul-de-sac*. L. Cahier (Revue de Chir., vol. xxvi, 1903).

Typhlitis. — This disease is characterized by a gradual onset, a typhoid course, and a prolonged convalescence.

Fæcal distension of the cæcum sometimes causes irritation of the mucous membrane, and presents symptoms similar to those of appendicitis. This condition may be excluded by the fact that the tumor preceded the pain, by the absence of vomiting and rigidity of the abdominal wall, and by the small amount of pain and tenderness. Typhoid fever is to be excluded by gradual rise and higher temperature range, by the absence of tumor and rigidity of the muscles in the right iliac region, and by the nervous

phenomena. The absence of fever by no means excludes appendicitis. Gallstones may be simulated by an abnormally located appendix which is inflamed. In the female inflammation of the Fallopian tube and extra-uterine pregnancy can usually be excluded by a bimanual examination in connection with the clinical history of these conditions. J. Garland Sherrill (Louisville Jour. of Surg. and Med., Apr., '99).

A number of cases of chronic colitis seen in which the question was raised as to whether the condition was not really a chronic appendicitis, but no case of acute appendicitis of so grave a nature had been seen as to make it unsafe to give a laxative or injection for fear of producing perforation where the question was raised as to whether the condition was really an acute appendicitis or acute colitis. When perforation is threatened in acute appendicitis, the diagnosis is usually not difficult to make. One or two cases of unmistakable chronic colitis personally seen which were entirely cured by removal of a diseased appendix. This would seem to indicate that the inflammation in these cases had begun in the appendix and extended to the colon, the primary and chief lesion, however, being in the appendix. McBurney (Med. Record, April 19, 1902).

Tubercular Typhlitis. — Slow asthenic course, diarrhœa, and a higher temperature usually distinguish this disease.

The diagnosis between appendicitis and tuberculous typhlitis is often obscure. The latter may be localized at one point of the cæcum, causing a small, hard tumor without viscous surroundings. Richelot (L'Union Méd., Nos. 39, 40, '92).

Case in which symptoms of appendicitis were such as to leave little room for doubt. Nevertheless, the appendix was free from disease, and tuberculous ulceration and narrowing of the cæcum were alone found after death to account for the symptoms. H. W. Page (Lancet, July 3, '97).

Tumors. — In cancer—the neoplasm which occurs most frequently in the intestines—the subject is usually beyond his fortieth year. Slow progress and the cachectic face are important differentiating signs.

Judgment should not be passed too hastily on tumors in the cæcal region; eight cases in which tumors of that region were connected with the cæcum. Richelot (L'Union Médicale, Apr. 2, '92).

Case of epithelioma of the cæcum and appendix simulating recurrent appendicitis. Sourdille (Bull. de la Soc. Anat., Dec., '94).

Myxoma of vermiform appendix simulating recurrent appendicitis, in a girl, aged 23, admitted with a history of two attacks of (supposed) appendicitis. The appendix was thickened at the end, and upon being opened showed a pellucid shining tumor the size of a small bean. No record of a similar specimen found. Churton (Brit. Med. Jour., May 15, '97).

In the case of a boy with symptoms of chronic appendicitis there was found by operation a round-celled sarcoma of the appendix with involvement of the mesenteric glands; patient recovered after removal of the cæcum, a portion of the ileum, and a V-shaped piece of mesentery. J. C. Warren (Boston Med. and Surg. Jour., Feb. 24, '98).

Anomalous cases of appendicitis which may be mistaken for neoplasms in the iliac fossa. A hard tumor develops slowly, with progressive emaciation and cachexia. After a long period the mass becomes softer, evidences of suppuration appear, and on making an incision pus is evacuated, the tumor then disappearing. Legueu and Beaussenat (Revue de Gynéc. et de Chir. Abdom., No. 2, '98).

Typhoid Fever.—Perforation occurs late in this disease, while the temperature, the petechiæ, and other characteristics readily serve to distinguish it.

When there is doubt as to whether a case is typhoid or appendicitis, the operation should be postponed if constitutional signs are severe and local ones hard of detection. When the abdominal symptoms — pain, tenderness,

rigidity, with or without distension—call loudly for operation, the abdomen must be opened, in spite of the possibilities of typhoid; but cases suggesting typhoid as strongly as appendicitis should, until the diagnosis is perfectly clear, be carefully observed. One should proceed in doubtful cases with extreme caution; every means of investigation should be exhausted before subjecting the patient to an operation. In those cases in particular in which the suspicion of typhoid fever is present, the abdomen should not be opened unless the indications are strong. When, in spite of repeated examinations and the greatest care, the surgeon is convinced that typhoid fever is not present, exploration, even if it proves him wrong and shows that typhoid does really exist, loses the sting of carelessness and haste. The blunders that mortify are those which would be unnecessary were the examination painstaking. M. H. Richardson (Boston Med. and Surg. Jour., Jan. 9, 1902).

In some cases the symptoms closely resemble those of pneumonia or pleurisy.

Distinction between pneumonia and appendicitis may be made by giving due consideration to the sudden rise of temperature to 103° F. or thereabouts, and the tendency to maintain this degree; the acceleration of respiration, which is out of proportion to the pulse-rate or the pyrexia; the relaxation of the abdominal walls between the respirations; the diminution or the disappearance of tenderness on deep pressure with the flat of the hand; the possible presence of cough. No operation for appendicitis should ever be performed until after a careful, or perhaps repeated, examination of the lungs has been made. Griffith (Jour. Amer. Med. Assoc., Aug. 29, 1903).

Disorders of the uterus, adnexa, and pelvic cellular tissue, especially salpingitis, are conditions which may cause confusion, especially the latter. Examination of the genito-urinary organs sometimes establishes the differential diagnosis.

By placing the patient on her left side with the shoulders low and the legs drawn up, it is much more easy to detect the position and condition of the appendix and also to differentiate it from the uterine adnexa than by palpation of the patient lying on her back. Even when no great intestinal distension is present, the depth at which the appendix might lie is greater, and the tension of the abdominal walls is likely to be more marked in the dorsal position than when this lateral method is employed, if no intestinal adhesions are present. (J. C. Simpson.)

In appendicitis the pains are more violent, but more strictly localized, and radiating pains are absent. In catarrhal salpingitis, especially if the ovaries share in the inflammation of the tubes, the pains radiate toward the thigh; the alarming symptoms also show a noticeable remission toward the third or fourth day. (Vineberg.)

In an acute progressive case the abdomen is so rigid that deep palpation is difficult and dangerous. A rigid abdomen is the principal differential sign between acute appendicitis and salpingitis. (R. T. Morris.)

Simple appendicular colic or parietal inflammation of the appendix may be accompanied, in hysterical persons, especially women, by nervous symptoms, simulating severe diffuse peritonitis. Talamon (Méd. Mod., No. 24, '97).

Six cases of appendicitis in the female in which it was impossible to positively establish the diagnosis before opening the abdomen. If the pain and the tumor are high up in the region of the right tube and ovary, appendicitis probably present. If the hymen is intact an inflammatory enlargement on the right side is probably due to appendicitis. Richelot (Le Gynéc., June, '97).

Acute puerperal parametritis may begin in the same manner as perforation of the appendix, but the symptoms are less severe, those of diffuse peritonitis being absent.

It is more difficult to distinguish between perforation of the appendix and the rupture of a pus-tube or ovary. If recovery takes place, the parametritis and paratyphlitis exudates can usually be diagnosticated by their characteristic shape and position. Krüger (Deut. Zeit. f. Chir., B. 45, H. 3 and 4).

Diagnosis is not easy when inflammation of the right tube and ovary and of the appendix occur at the same time. We have in both rapid pulse, rise of temperature, pain, vomiting, and tympanites. However, appendicitis begins more acutely. If a chronic case, there is a history of one or more former sharp and sudden attacks. Lesions of tubes and ovaries are of older date and have a history of menstrual disorder. Pain of appendicitis is acute, frequently violent, beginning over the solar plexus, radiating over the whole belly, and finally settling in the right iliac region. In adnexal disease the pain is dull and heavy, and never sharp and lancinating until the peritoneum is involved. Patient is more alarmed in appendicitis than in disease of the adnexa. Location of tenderness is different: in appendicitis it is on a level with the anterior spine; in adnexa, trouble is in the pelvis. In the latter, vaginal examination reveals the site of tenderness; in the former, one can touch and move the organs in the pelvis without producing pain. Vomiting is more common in appendicitis. Rigidity of the muscles of the abdominal wall over the right iliac region is almost always present in appendicitis, and generally absent in inflammation of the tubes and ovaries. In case of doubt chloroform should be given, and by its aid the enlarged and tortuous appendix can be felt or by a bimanual examination disease of the adnexa may be discovered. Hunter McGuire (Southern Med. Record; Canada Lancet, May, '98).

Neuralgia in the region of the appendix, renal colic, particularly when protracted and febrile, cholecystitis, perforation of duodenal or other ulcers along the gastro-intestinal tract and diseases of the internal genitalia may simulate this affection. E. G. Janeway (Med. Record, May 26, 1900).

Appendicitis is much more common in women than is supposed, because of the frequency with which it is mistaken for ovaritis of the right side. Several personal patients had been treated for a prolonged period. The pain of appendicitis is more sudden in its onset, and much more acute and is often accompanied with nausea. Muscular spasm is usually marked; the general disturbance is greater, and the progress more rapid. An intact hymen points to appendicitis. F. W. McRae (N. Y. Med. Jour., Feb. 2, 1901).

Miscellaneous Disorders.—According to Deaver, *movable kidney* is to be differentiated as follows: In appendicitis there is more apt to be fever and increased pulse-rate, the rigidity of the abdominal wall does not involve such a large area, there is a circumscribed and acutely-tender point, the tenderness is more superficial, and there is an absence of a movable tumor which readily slips from between the examiner's fingers.

Chronic appendicitis is present in from 80 to 90 per cent. of women with symptom-producing movable right kidney. This frequency constitutes chronic appendicitis one of the chief, if not the chief, symptoms of movable kidney. Twenty per cent. of all women have movable kidney or kidneys; 4 per cent. of all women have symptom-producing movable kidney or kidneys; 4 per cent. of all women have appendicitis, while 3 ½ per cent. of all women have both symptom-producing movable kidney and appendicitis; only ½ per cent. of all women have appendicitis and well-anchored kidneys. A movable left kidney never produces appendicitis. Movable right kidney probably produces chronic appendicitis by indirect pressure upon the mesenteric vein, the return-circulation of the appendix being hampered by compression of the vein between

the head of the pancreas and the spinal column. George M. Edebohls (Postgraduate, Feb., '99).

Infectious catarrhal *inflammation of the bile-ducts* and ulceration of these ducts may occasionally simulate appendicitis. Biliary colic is to be differentiated by jaundice, absence of fever, peculiar color of the stools, finding of gall-stones in the passage, and by the more severe and continuous pain, radiating usually from the chest-margin to the umbilicus.

Simple *empyema of the gall-bladder* is diagnosed by the onset, the location and character of the pain and tenderness, and by the area and degree of rigidity.

Acute *phlegmonous cholecystitis* and gangrene of the gall-bladder may usually be diagnosed by the existence of more acute symptoms, more general peritonitis, by the rapid and shallow respiration, location of the pain and tenderness, and by the greater tendency to a rapidly fatal issue.

Perforated gastro-intestinal ulcers are diagnosed by predisposing age, history of previous gastric or intestinal disturbances, sudden acute pain in the epigastrium, followed by collapse, and last by the presence of bloody vomiting, or, in the case of intestinal ulcers, by the hæmorrhage from the bowel. Perforation occurring in typhoid may be very difficult to tell from a concurrent appendicitis.

Extra-uterine pregnancy is to be recognized by the existence of the usual subjective signs of pregnancy, by vaginal examination, and by the absence of inflammatory symptoms prior to the rupture. (Annals of Surg., Mar., '98.)

Etiology and General Characteristics.—Young adults, especially males, constitute the majority of cases. Appendicitis occurs at all ages, however, though very rarely during infancy.

Among 489 cases found in literature 392 were males and 97 females. Pravaz (Thèse de Lyon, '88).

Of 90 cases, 73 per cent. were under thirty years of age; 76 per cent. were males, 24 per cent. females. Bigelow (Vis Medicatrix, Oct., '91).

Report of 517 cases seen in the leading Montreal hospitals showing the condition to be most common between the ages of twenty and thirty, and to occur twice as often in males as in females. G. A. Armstrong (Lancet, Sept. 18, '97).

Study of 80 cases treated by Broca; 70 not previously published. Proportion of boys to girls, 58 to 21; 5 were aged between 2 and 5, 25 between 5 and 10, and 41 between 10 and 15 years. Mlle. Gordon (Thèse de Paris, No. 101, '97).

Heredity seems to act as a predisposing factor in connection with an arthritic diathesis.

Heredity as a predisposing cause. The author refers to the fact that foreign writers have reported a number of families in which this disease was frequent. Talamon says that the reason this subject has been overlooked in medicine is due to the fact that the clinical forms and methods of treatment of appendicitis have been discussed, to the neglect of the etiology. The author reports three family histories in which appendicitis and bowel disturbance were very common. In the first family there was a train of symptoms going through all the members of the second generation. These refer to gastro-intestinal disorders associated with nervous symptoms and circulatory disturbance. In the third generation there was appendicitis. In the second family the father probably had appendicitis, and he as well as the mother had constipation. All the members of the second generation had some gastro-intestinal disturbance. Three of the members of this family had appendicitis. In the third generation of the same family constipation was the rule, and in the fourth

generation there were two cases of gastrectasis. F. Forschheimer (Amer. Med., Oct. 5, 1901).

The local inflammation may be caused by the intrusion of:—

1. Micro-organisms, specific, and non-specific, of which constipation, dietetic indiscretions; neighboring catarrhal, typhoid, and tubercular processes; constriction, torsion, or strain are the primary etiological factors. Cases due to actinomycosis are occasionally observed. Traumatism, blows upon the abdomen, etc., sometimes produce inflammation of the appendix.

A strain may apparently originate an attack: a point of medico-legal importance. An already damaged appendix is especially susceptible to such injury. Many acute attacks of appendicitis commence during sleep. Rutherford Morison (Edinburgh Med. Jour., Mar., Apr., May, '97).

In three hundred male and one hundred and eighteen female adult autopsies the appendix was found so frequently adherent to the psoas muscle while free from adhesions when situated elsewhere that the conclusion that trauma of the psoas muscle is most productive of appendicitis is inevitable. B. Robinson (Annals of Surg., Apr., 1901).

Three cases showing that a slight injury may give rise to a fatal attack of appendicitis. A small deposit of hard fæcal matter in the appendix may, after prolonged retention, set up localized necrosis, which is not likely to cause mischief so long as it involves only the inner layers of the appendical wall. Any injury inflicted on the abdomen may rupture the intact external coat, and cause the infected contents of the appendix to penetrate the abdominal cavity. Direct or indirect traumatism may produce an attack of appendicitis in a healthy subject, but in most traumatic cases a laceration caused by a confined enterolith is the starting-point of the inflammation. Schottmuller (Mitt. aus der Gren. der Med. und Chir., B. vi, H. 1 and 2, 1901).

Lucas-Championnière admits the increasing frequency of the disease and gives full due to the theory of intestinal infection. Inquiring what gives rise to the greater frequency of such intestinal infection than took place formerly, he concludes that it is the grippe, and that appendicitis is indeed a new disease, having its origin in the grippe, which became epidemic about fifteen years ago. A cause contributory to and of as much importance as the grippe he asserts to be the eating of meat. He finds that appendicitis is confined chiefly to countries where meat forms a large part of the people's food and that it is invariably most severe in those who eat meat in excess, while vegetarians are almost free from it. Interesting statistics, covering many countries and years, are offered as proof. In every section of France the frequency of appendicitis increases in direct ratio to the increased consumption of meat. In convents, schools, prisons, asylums, where the diet is almost, or even entirely, vegetarian, cases of appendicitis are very rare. In one prison with 1000 prisoners only 1 case in four years, in another with 2000 inmates 2 mild cases during 1903, one of them of long standing; in an asylum with 1500 inmates not a case in three years. In Roumania 1 case of appendicitis among 22,000 sick persons of a vegetarian population; 1 case among 221 sick persons, meat-eaters. In Porto Rico the disease has not appeared among the natives, who are vegetarians, but is not uncommon among the Americans. On the basis of these observations it is easy to understand why appendicitis occurs with so much greater frequency in the United States than anywhere else, since animal food is an exceedingly large part of the people's diet. H. Speier (Wisconsin Med. Recorder, Sept., 1904).

2. Irritating fæcal matter, which frequently forms hard egg-shaped fæcal concretions of various sizes; foreign bodies, —cherry-stones, orange-seeds, buttons, spicules of bone, etc.,—which penetrate into the interior of the appendix through

deficient action of a valve which usually closes its opening, or on account of excessive patency of the latter. Grape-seeds were at one time thought to play an important rôle as etiological factors, but a painstaking investigation by Edmund Andrews showed that this was not based on facts. Indeed, it is quite probable that foreign bodies play a very small part in the production of attacks of appendicitis, hardened fæcal masses being excluded.

The vermiform appendix is a common habitat of thread-worms; very probably they breed there. In 200 autopsies on children under twelve years of age thread-worms were present in the intestines in 38, or 19 per cent., and in those children over twelve years of age the percentage was much higher, viz.: 32 per cent. In no less than 25 out of the 38 cases the worms were found in the appendix, and in 6 the appendix was the only part of the alimentary canal where the worms were found. In 1 case where pain had been complained of in the right iliac fossa the appendix contained 111 worms, and was in a catarrhal condition. In several other cases the appendix was in a similar condition. The idea that thread-worms are chiefly found in the lower part of the colon is therefore erroneous, and injections, in order to be effective, must be sufficiently bulky to reach the cæcum, as much as 16 to 20 ounces being often tolerated by children of from six to twelve years of age. Still (Brit. Med. Jour., vol. i, p. 898, '99).

One thousand four hundred cases collected from various sources in the last ten years, and only about 7 per cent. found of true foreign bodies. In 700 of these cases in which definite statement was made as to the nature of the foreign bodies, 45 per cent. were fæcal concretions. The only foreign body observed in 250 cases of appendicitis at the Johns Hopkins Hospital was a segment of a tape-worm. J. F. Mitchell (Johns Hopkins Hosp. Bull., Jan., Feb., Mar., '99).

Notwithstanding the frequency of worms (ascarides and trichocephali) among the Chinese and Europeans living in China, not a single case of appendicitis met with in the European population, some 120 persons, under personal care. Yet in a young Russian woman and in two missionaries abdominal pains suggesting appendicular colic seemed to depend on the presence of a tænia; they ceased on the expulsion of the parasite. The rarity of appendicitis in the Chinese appears to confirm the opinion of Keen and Lucas-Championnière as to the predisposing influence of meat diet, meat in China being a luxury within the reach of few. Matignon (Bull. de l'Acad. de Méd., Mar. 26, 1901).

Case in which the vermiform appendix had been the seat of almost constant dull pain. The appendix was much thickened; in its interior were found small fæcal concretions and also a piece of eggshell. It was verified as eggshell when examined in a chemical laboratory. Boldt (Amer. Jour. of Obstet., Mar., 1903).

General Pathogenesis. — The vermiform appendix is a glandular organ presenting a certain analogy to the tonsils and liable, as well, to follicular, mucous, submucous, infectious, exudative, and ulcerative disorders.

Like the tonsil, the appendix abounds in closed adenoid follicles, and, like tonsillitis, appendicitis recurs in patients who are predisposed to it. Since tonsillitis is one of the most frequent manifestations of influenza due to a change in the seasons, it is not to be wondered at that appendicitis should occur under the same conditions. Three illustrative cases. P. Merklen (Univ. Med. Jour., Apr., '97).

An absolutely healthy appendix is never attacked by appendicitis, but may become involved by continuity from catarrhal inflammation of the cæcum. Appendicitis has always a gradual beginning without symptoms, followed by signs of sudden acute inflammation. A pointed foreign body in the appendix may give similar symptoms rapidly followed by perforation. The appendix is

predisposed to attacks by chronic illness. While fæcal concretions are usually found in a healthy appendix, they may occur in granular or tubercular appendicitis. Stricture or stenosis of the appendix may occur. Non-purulent appendicitis rarely contains a fæcal concretion. Gangrene occurs earlier in purulent than non-purulent appendicitis; gangrene is more rare with stricture or stenosis of the appendix than with granular appendicitis. Minute hæmorrhages occur and the infection reaches the lymph-channels. Periappendicular abscess may develop without perforation, rarely even at some distance from the appendix, and may be wholly absorbed, with recovery. Stenosis of the appendix rarely heals spontaneously, and the presence of a concretion usually causes suppuration, though it may reach the cæcum. Only about one-third of all cases run a mild course. Of 282 patients with appendicitis, but 84 were non-purulent. Riedel (Archiv f. klin. Chir., vol. lxvi, Nos. 1 and 2, 1902).

In the severer forms of the disease, associated with abscess or peritonitis, the micro-organisms can be readily determined. In the pus within or outside the appendix many varieties of bacteria are found, the bacillus coli communis most frequently. Ordinarily harmless, it may become virulent, especially where associated with streptococcus. Other organisms found in this disease are the staphylococcus pyogenes aureus and citreus, pneumococcus, B. pyocyaneus, proteus, various anærobic and putrefactive bacilli, and those of influenza, diphtheria, glanders, and tetanus. Actinomycosis may be a cause, and tuberculosis and typhoid ulcers may be associated with it. The mucous membrane of the appendix contains Lieberkuhn's follicles and Peyer's patches, also much lymphoid tissue. The function of the latter is to destroy invading microbes, but it may be destroyed by them without resulting appendicitis. The bacterial activity is at its maximum in the cæcum, and as the contents of the latter are fully digested and semifluid, they form a good medium for microbial growth. In many cases of the disease concretions, ulcers, and narrowing of the lumen act as contributing causes. True foreign bodies are rarely a cause. It is encouraged by constipation, the use of purgatives, indigestion, bad teeth, and the uric acid diatheses. It is three or four times more frequent in men than in women. It is very common among children, 40 per cent. of all cases occurring between the tenth and twentieth years. This may be due in part to the larger amount of lymphoid tissue in the appendix during the earlier years of life. Children are also prone to catarrh of the bowels, which may result in infection of the appendix. Several members of a family may suffer from the disease, thus showing a particular family tendency in this direction. Bottomley (Practitioner, June, 1905).

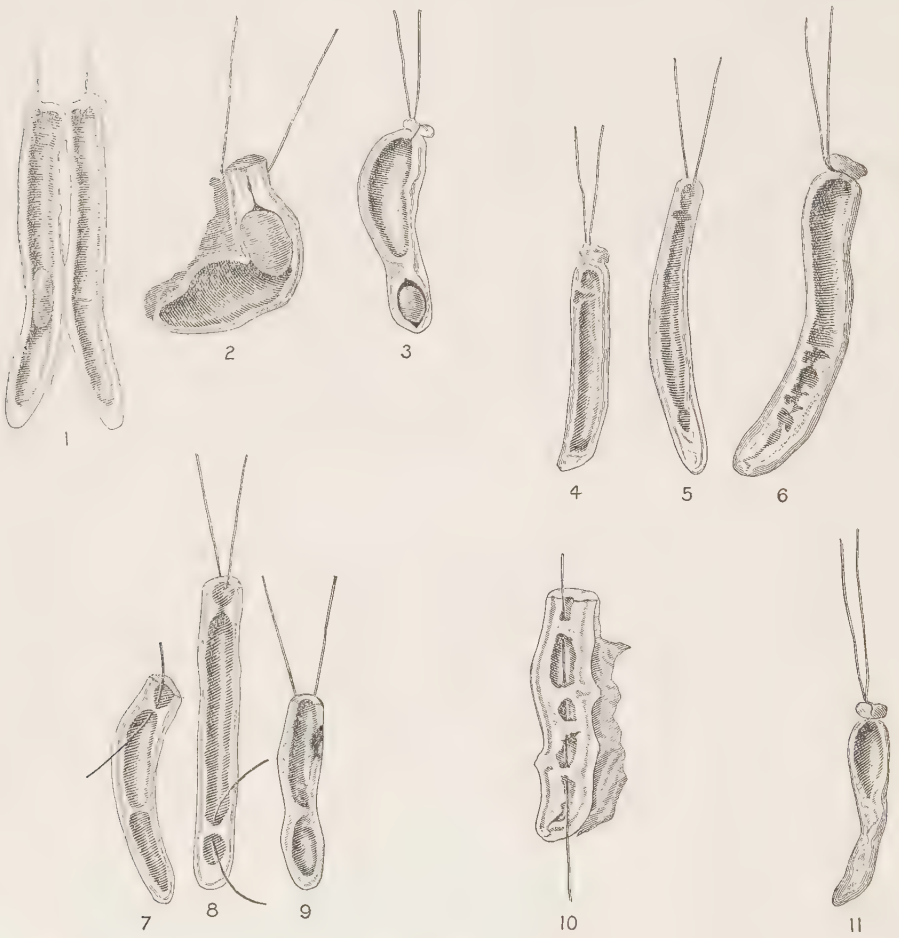
An appendicular inflammatory process is almost invariably started by the bacillus coli communis. In a certain proportion of cases other micro-organisms, especially the staphylococcus pyogenes and streptococcus, are also found.

The coli bacillus, undoubtedly, may alone exist in the exudate. In 20 cases examined, all purulent, 10 were associated with other bacteria, the most important of which in 6 cases was the streptococcus. It is probable that in appendicitis the coli bacillus is aided by other bacteria, which it soon outnumbers and destroys. Achard and Broca (Gaz. Heb. de Méd. et de Chir., Apr. 1, '97).

New method of studying the removed appendix. Within a few hours after removal the appendix should be distended with 95-per-cent. alcohol, through a conical nozzle of a small syringe tied tightly into its cut end by a ligature, which is tightened as the syringe is withdrawn. The distended organ is then immersed twenty-four hours or more in alcohol of the same strength. It is then ready for section. If it is sliced centrally from end to end, its interior will be a revelation to the surgeon. Whereas the outside may preserve the cylindrical form of a normal appendix, and may give little or no evidence of inflammation, the interior (if the patient has had one

or more attacks) will show one or several of the conditions illustrated by the annexed cuts. Robert Abbe (Med. Record, July 10, '97).

Histological study of the various forms of follicular appendicitis: 1. Recurrent appendicitis has its principal location in the follicles. 2. Fæcal concretions, which are frequently found in appendicitis, are a result of the appendicitis; they are not formed from the fæces and contain no food-remnants, they are derived from the mucous secretion of Lieberkühn's glands; the latter are hypertrophied from their activity. 3. The obliteration of the vermiform process is a pathological process which follows follicular appendicitis. 4. Gangrenous appendicitis in which all the coats of the organ are destroyed simultaneously is fortunately of rare oc-



Figs. 1, 2, and 3.—A fæcal concretion blocking the canal.
Figs. 4, 5, and 6.—Interior ulcerations.
Figs. 7, 8, and 9.—Cicatricial strictures, often of pin-hole aperture only.
Fig. 10.—Multiple strictures with intermediate pockets, containing suppurating and catarrhal products and confined by greatly hypertrophied muscular and mucous coats.
Fig. 11.—Partial obliterating appendicitis.
These five varieties are subject to minute variations. (*Robert Abbe.*)

currence. Pilliet (Le Prog. Méd., Jan. 29, '98).

There are at least four distinct varieties of appendicitis obliterans: an exudative variety; a variety characterized by mucosal hyperplasia, and sclerosis; a variety characterized by submucous hypertrophy; a reparative variety. In all

U-shaped appendix with central constriction. Lower segment found empty. (*Brun.*)

(La Presse Médicale.)

varieties there may be and generally is localized peritonitis; endarteritis and periarteritis are almost constant phenomena in the disease. The vermiform appendix, in health, is distinctly muscular; in disease the muscles often hypertrophy. J. F. Binnie (Annals of Surg., May, '98).

Appendicitis should be regarded as an inflammation of the vermiform process due to infection. The streptococcus lanceolatus, the bacillus pyogenes, the bacillus subtilis, the staphylococci, the bacterium coli commune may each be responsible for the infection, but in the large majority of instances the culture will be found to contain either the bacterium coli commune alone or in conjunction with one of the other aforementioned organisms. It is a well-known fact that these organisms may exist in the intestinal tract without provoking infection, but that when there is any circulatory disturbance or injury to the mucous membrane their virulence increases, and infection is apt to follow. Carl Beck (N. Y. Med. Jour., Nov. 19, '98).

Virulence of the bacillus coli in experimental appendicitis. Increased virulence of the B. coli and appendicitis can occur without occlusion of the cavity of the appendix; suppurative appendicitis can occur as a result of nutritional changes in the appendicular parietes, and this without an increased virulence of the B. coli contained in the pus. Charles de Klecki (Ann. de l'Institut Pasteur, June 25, '99).

Of all the etiological factors that enter into the pathogenesis of appendicitis, imperfect drainage of the organ plays the most conspicuous part. Whenever this is present, and exists for only a brief period of time, there are bound to arise very definite and at times serious consequences. As a result of the interference with drainage, the bacillus coli communis is changed into a virulent organism. Next in importance to the part played by insufficient drainage and increased activity of micro-organisms is the question of circulatory disturbances. The insignificance attached to the presence of foreign bodies in the human appendix

Cystic appendices with thin walls and filled with sero-purulent fluid, but having open, though small, canals. (*Brun.*)

(La Presse Médicale.)

was well borne out by the experimental work. C. H. Frazier (William Pepper Laboratory of Clin. Med., 1900; Medicine, Aug., 1900).

Appendicitis almost always precedes an attack of perityphlitis or paratyphlitis.

Records of one hundred post-mortem examinations, 91 per cent. of which showed that the disease had started in the vermiform appendix. Primary perforation of the cæcum was observed in only 9 per cent. of the cases. Einhorn (Münchener med. Woch., Nos. 7 and 8, '91).

The affection may start either in the cæcum or the appendix, but with marked predilection for the latter. Herman Mynter (Deutsche med. Woch., Apr., '91).

In three hundred and twenty-four cases the appendix was found to be the seat of the disease two hundred and eighty-two times. The importance of the appendix as a starting-point for disease is beyond dispute. Hartley (N. Y. Med. Jour., June 25, '92).

Post-mortem records at Munich fully bear out the generally received idea that the appendix is primarily involved. Haenel (Münchener med. Woch., Mar. 26, '95).

Pathology of Various Forms. — The simple catarrhal form is usually caused by constipation or indiscretion in diet, in which the inflammatory process, after passing through an acute stage, including more or less epithelial desquamation, excoriation, etc., and involving the mucosa, submucosa, and the serous layer and the overlying area of peritoneum, gradually recedes. The appendix remains very vascular and functionally weakened, and is subject to renewed attacks of inflammation.

The ulcerative form, in which the inflammation is usually produced by fæcal concretions or foreign bodies, gradually proceeds to ulceration. An opening becomes formed near the apex of the organ and the fæcal concretion or foreign body escapes, with the septic discharges formed, into the abdominal cavity.

The majority of primary attacks of appendicitis occur through an eroded mucous membrane, caused by masses of fæcal matter, rarely by a foreign body. Fæcal matter is introduced into the lumen of the appendix by contractions of the cæcum. The expulsive force of the appendix is not sufficient to expel it, and hence it remains to irritate the mucous layer, at first merely by its presence. The slight muscular movements of the appendix tend to mold the mass into a round or oblong shape. This mass is augmented by the natural secretions of the mucous membrane of the appendix and by further accessions of fæcal matter from the cæcum. Gradually the concretion increases in size until it irritates by causing pressure against the walls of the organ. This is followed by a decided erosion of the mucous membrane, and this by an invasion of the micro-organisms which are always present in fæcal matter. They proliferate, and the inflammatory troubles then begin. In a few cases the increased secretion of the mucous layer may cause partial liquefaction of the fæcal concretion, which may be expelled. In the majority of cases, however, the concretion remains in the lumen, where it is found to act as an exciting cause of further inflammatory trouble. J. B. Deaver (Amer. Jour. Med. Sciences, Aug., '97).

Anything that could remove the epithelial lining from the mucous membrane of the appendix might be the starting-point of the mischief. G. A. Armstrong (Lancet, Sept. 18, '97).

The idea embodied in the word catarrhal appendicitis is a correct one in the very early stages in the morbid condition. Excluding the rarer cases when foreign bodies are entrapped, or in which there is kinking of the appendix from its short mesentery, the origin of the stricture is found in one of two causes: septic and linear ulcer or the contraction of the catarrhal inflammation, antedating this stricture by many years. From this study it may be said with certainty that the first attack of appendicitis recognized by the patient is in most cases the end of the disease, for the appendix shows the presence of a stricture which may have existed for many years. The most complete experience clinically of the variations in the

symptoms is often required to differentiate between the disease in question and so unlike a malady as typhoid fever. The latter study of leucocytosis throws much light upon the differential diagnosis. Attacks may often be cured by natural methods; that a long respite does not mean a cure, and that it is impossible to predict a cure; and, finally, that, unless the appendix is removed, the disease is always latent where once it is begun. Robert Abbe (Med. Record, Feb. 16, 1901; Phila. Med. Jour., Feb. 23, 1901).

The following classification proposed:

ACUTE APPENDICITIS.

First .....Catarrhal.
Second .....Interstitial.
Third .....Ulcerative.
Fourth .....Gangrenous.

CHRONIC APPENDICITIS.

First .....Catarrhal.
Second .....Interstitial.
Third .....Obliterating.

The appendix is the most vulnerable of the abdominal organs because of its deficient blood-, nerve-, and lymphatic supply, its length and calibre, and because of its liability to traumatism in its association with the psoas muscle. The majority of cases are of a chronic nature, and not infrequently the whole pathology of appendicitis is demonstrated in one patient. Obliteration of the lumen of the appendix is rare and never to be relied upon. The rapidity and suddenness with which the organ may become diseased and gangrenous, giving rise to a fatal peritonitis, emphasized.

The three principal symptoms are pain, tenderness, and rigidity. The most important of these, pain, is paroxysmal, and may, at intervals, almost disappear. Its location entirely depends upon the position of the appendix. It is well to always palpate at a point some distance from the supposed seat of disease and then gradually approach the point of tenderness. Abrupt cessation of pain implies gangrene. Both temperature and blood-count are of little value as diagnostic signs. J. B. Deaver (Jour. Amer. Med. Assoc., July 13, 1901).

In one hundred and forty-six cases collected by Matterstock perforation was found to have occurred one hundred and thirty-two times.

The complications following perforation vary. Normally the peritoneum completely surrounds the appendix and the cæcum, and a localized peritonitis and a perityphlitic abscess necessarily follow.

If, however, through previous local inflammation, close adhesions have united the appendix and the peritoneum, both organs are perforated simultaneously, and the appendical contents may pass entirely through the peritoneal coats. This gives rise to an extraperitoneal abscess, which may open externally above Poupart's ligament or within the abdomen into the small intestine, the bladder, the vagina or the rectum, the portal vein, the iliac artery, etc.

Two cases complicated with phlebitis of the left leg. In one case pain in the left leg occurred the second day, followed by dyspnœa and fever on the third. A day later marked phlebitis appeared. Cough with bloody expectoration followed, with all the signs of a pulmonary infarct. The second case was one of purulent appendicitis and phlebitis. Two other cases referred to. Of the four, two died. A peculiarity is that it occurs more frequently on the left side. It is evidently due to metastasis through the circulation. Its occurrence makes the prognosis unfavorable. Villard and Vignard (Revue de Chir., Jan., 1901).

Two cases of thrombosis of the femoral veins following appendectomy. Excessive pain in the left groin, followed a few days later by œdema of the leg and the infiltrated vein, were the main signs. Infection is probably the causative factor of this complication rather than the mechanical theory of Lennander. W. Meyer (Annals of Surg., May, 1901).

A general review of literature and 39 personal cases have shown that lymphatic and hepatic infections are more common than is realized. The two infections are frequently associated, and one type may be the source of origin of the other. In certain cases of hepatic abscess, the source of infection, whether through the portal canals or through the lymphatics, cannot be determined either clinically or at operation. The type of infection does not depend upon the gravity of the originating appendicitis. Subphrenic infections must not be isolated in a class by themselves, as they depend on both lymphatic and hepatic infections, and *vice versa*. Hepatic infections are not uniformly distributed even when originating in the portal tract, the left lobe being solely affected at times.

The prognosis of lymphatic (including the subphrenic) infections is better than that of hepatic, but, when the latter are secondary to lymphatic or direct mechanical invasion, the outlook is more favorable than in the true portal invasions. The most important clue in making a diagnosis is the recognition of the causative appendicitis, and the elimination of this possible cause is necessary in dealing with obscure hepatic invasions in the presence of plasmodia, the Widal reaction, etc. Early recognition and removal of the inflamed appendix may abort a secondary infection of the type considered here, but the corollary does not necessarily follow. The characteristic signs and symptoms are well established in typical cases, and should form a basis for diagnosis in atypical cases. John C. Munro (Annals of Surgery, November, 1905).

Pleurisy, due to propagation of the inflammation through the retroperitoneal cellular tissue, or through the lymphatic system, is an occasional complication, but often passes unperceived. It is almost invariably on the right side, and is rarely bilateral.

Out of 45 cases recorded 3 were of the dry form, in 29 the effusion was serous, while in 13 the liquid was purulent, with marked dyspnœa and intense fever. The prognosis of the appendicitis is only affected by the pyæmic form of pleurisy, the serous form frequently disappearing of its own accord. The lungs should be carefully watched in all cases, therefore, lest the aggravated pleurisy intervene to seriously compromise the result. Croizet (Thèse de Lyon, '93).

Pleurisy is generally a local complication, a pleural abscess by contiguity. While metastatic pleurisy may coincide with infarct on either side, the latter will be upon the right side always, preceded and accompanied by subphrenic suppuration. In 13 cases from the literature, right-sided pleurisy was found post-mortem with subphrenic abscess, showing the extension from the appendix through the diaphragm into the pleura. The physical signs simulate purulent pleurisy. The prognosis is grave; the diagnosis always difficult. L. Lapeyre (Revue de Chir., May, 1901).

If there is no adhesion between the appendix and the peritoneum suppurative peritonitis is produced, and this process usually gives rise to a protective plastic exudation, which causes the surrounding loops of small intestine to adhere together and inclose the secondary abscess, thus temporarily protecting the surrounding parts.

If, however, the plastic inflammation does not induce protective adhesion between the intestinal loops, the septic material invades the whole peritoneal cavity, and gives rise to diffuse and fatal peritonitis.

Case of appendicitis complicated by acute parenchymatous nephritis. Probably due to fact that the toxins generated by the virulent coli communis irritate the renal epithelium. Moldavski (Vratch, May 12, 1901).

Forty-five cases of subphrenic abscess as a complication of appendicitis collected from literature and personal case show that the complication is a very rare one and that many were not diagnosed until after the death of the patient. It may be extraperitoneal or in-

traperitoneal. J. McF. Gaston (Med. Record, Mar. 23, 1901).

When appendicitis is protracted, a fæcal fistula often results. In one of three fatal cases of perforation of the cæcum following appendicitis, fæcal matter escaped and formed a circumscribed peritoneal abscess, between the folds of the small intestine. In the other two perforation occurred in the cæcum, circumscribed abscesses being also found. When appendicitis is protracted, the mesenteric glands swell and peritonitis may follow. As fæcal matter may enter the peritoneum, an early laparotomy will be necessary. E. Rose (Deutsche Zeit. f. Chir., Feb., 1901).

Prognosis. — Death may occur very early, especially in children, who are also more liable to peritonitis than adults. The danger of death is greater in men than in women.

It is in the first twenty-four hours from the beginning of the attack that we can decide not only as to the diagnosis, but as to the probable course and result of the case. If in five or six hours there is no increase in urgency, the patient is not in immediate danger, kept at perfect rest in bed; if in twelve hours there is still no increase in the severity of the symptoms, the patient should soon begin to improve. If the urgency of the case has steadily increased in twelve hours from the time when the diagnosis was made, an operation will probably be called for. After two attacks a patient is sure to have a third, and each attack renders operation more difficult and dangerous. All the advantages lie with operation between the attacks. In an operation during an acute attack the prognosis is worse. McBurney (Med. News, No. 24, '96).

Conclusions based on 213 personal cases:—

1. Cases with early fever (104° F.), with defervescence on third or fourth day, recovered rapidly.

2. Similar onset, but more prolonged fever, with fall of temperature about the fifth day to 102° F. Of 14 cases, 3 were operated on for abscess and all cured.

3. Temperature after fifth day still over 102° F.: infection virulent and prognosis unfavorable. Of 11 such cases 2 died, 2 were cured without operation, 4 were operated on, and 3 recovered after long illness due to perforation into the bowel.

4. Recurrence of fever after early defervescence. Of 6 such cases 4 were operated on; 1 died from peritonitis.

5. General peritonitis, with serious infection, low temperature. In these cases the state of the pulse gives indications as to the severity of the disease. J. Rotter (Centralb. f. Chir., Oct. 24, '96).

Reference made to 32 cases of appendicitis during and after pregnancy, 4 of which were personal. In the 32 cases there were 10 deaths, a percentage of 31, which is much higher than that of Armstrong in his series of 517 cases, with a mortality of 12.8 per cent. The only complication of importance in appendicitis occurring during pregnancy is abortion, noted in 40 per cent.; this accounts for fact that in half the 32 cases the children died. Appendicitis during pregnancy should be treated like ordinary appendicitis. Vinay (Lyon Méd., Jan. 2, '98).

The gravity of appendicitis is considerably increased when that disease is complicated by pregnancy. One author estimates the mortality of appendicitis during pregnancy at 31.2 per cent. and that of appendicitis in general at 12.8. Bué (La Méd. Mod., Mar. 12, '98).

Improved methods of treatment, especially the early evacuation of pus and a better understanding of the symptoms, have brought the mortality down from 30 per cent. to 8 per cent.

Statistics of four hundred and fifty reported operations during the interval between the attacks showing eight deaths, which would give a mortality percentage of 1.77. If all cases were reported, 5 or 6 per cent. would be a fairer estimate. We need more carefully recorded cases. Bull (N. Y. Med. Record, Mar. 31, '94).

The surgical death-rate in acute and chronic appendiceal cases, without abscess, is a fraction of 1 per cent. at the

hands of several American surgeons, and it is believed from classified data that the eventual death-rate in appendicitis cannot be much less than twenty-five per cent. The loss of time and sufferings are also much less under proper surgical treatment than under the best medical treatment. Robert T. Morris (Med. Times, Apr., '98).

Seven hundred and fifty cases of appendicitis personally observed show that out of 464 acute cases, 284 were operated on, with 63 deaths, giving a mortality of 21 per cent.; 149 cases recovered without operation, and 31 cases were moribund when first seen by the surgeon.

One hundred and fifty-one cases were operated on in the "interval" (*i.e.*, after an acute attack had subsided, or between two acute attacks in chronic cases). All of these recovered.

Out of 180 cases treated medically, 31 died, giving a mortality of only 17 per cent., as against 21 per cent. in the acute cases operated on by the authors. But it must be observed that some of the 31 cases might have recovered by operation; on the other hand, it may be argued that, of the 63 fatal cases operated on, some might have recovered under medical treatment only. If all cases were seen by the surgeon on the first or second day, every fatal case would be operated on at a time most favorable for cure.

Seven per cent. of all cases treated by other than surgical means when first attacked will die, and the mortality of all cases treated in this way which pass to a second attack is 14 per cent. On the other hand, chances are three to one against a recurrence. Operation by experts is practically without mortality; but those who are inexperienced in abdominal surgery take great risks. Every case requires consultation. M. C. McCannon (Med. and Surg. Bull., Aug. 9, '98).

The more frequent complications that may thwart all plans of treatment even in the presence of the most careful technique: 1. General septic peritonitis. 2. Intestinal obstruction, due to kinking of the recently separated intestine or to adventitious bands. 3. Retroperitoneal abscess. 4. Fæcal fistula. 5. Multiple abscess of the liver. 6. Gangrene of the cæcum. 7. Phlebitis of the femoral vein. 8. Communication of the abscess with the rectum, vagina, or bladder. 9. Ventral hernia. 10. Fatal hæmorrhage. 11. Parotitis. 12. Empyema. 13. Pericarditis. R. A. Sterling (Intercol. Med. Jour. of Australasia, Aug. 20, '98).

The mortality in appendicitis results from the extension of infection from the appendix to the peritoneum or from metastatic infection from the same source; this extension can be prevented by removing the appendix while the infectious material is still confined to the organ. The distribution or extension of the infection is accomplished by the peristaltic action of the small intestines, and by operation after the infectious material has extended beyond the appendix and before it has become circumscribed. Peristalsis of the small intestine can be inhibited by prohibiting the use of every form of nourishment and cathartics by mouth and by employing gastric lavage in order to remove any substance of food or mucus from the stomach. The patient can be safely nourished during the necessary period of time by means of nutrient enemata. In case neither food nor cathartics are given from the beginning of the attack of acute appendicitis and gastric lavage is employed, the mortality is reduced to an extremely low percentage. In patients who have received some form of food and cathartics during the early portion of the attack, and who are consequently suffering from a beginning diffuse peritonitis when they come under treatment, the mortality will still be less than 4 per cent. if peristalsis is inhibited by the use of gastric lavage and the absolute prohibition of all forms of nourishment and cathartics by mouth. A. J. Ochsner (Med. News, May 2, 1904).

Cases of simple catarrhal appendicitis with adhesive peritonitis almost invariably get well.

Cases in which extraperitoneal perforation occurs generally recover, unless the abscess opens into the bladder or the pleura, when recovery is doubtful.

Cases in which invasion of the general peritoneal cavity by septic material has occurred usually ends fatally.

Recovery in a case of profuse septic peritonitis. The protecting wall of the inflammatory adhesion was incomplete, and the septic process extended to the liver and the whole right abdominal cavity. The pelvis was filled with purulent fluid and fæces. Appendix gangrenous and left in. Kakeles (N. Y. Med. Jour., July 6, '95).

Case of fulminating appendicitis. The patient, a girl aged 25 years, was operated upon at 5 P.M., twenty-four hours from the beginning of the active symptoms. The peritoneal cavity was found to contain about two quarts of pus, the intestines being coated throughout with thick layers of lymph. Although at first the prognosis was exceedingly bad, the patient was convalescent at the time the report was published. McCosh (Annals of Surg., Feb., '97).

A sharp distinction can be drawn between cases of appendicitis that should be treated surgically and those that should not. The writer asserts that not one case of appendicitis in ten requires operation; and if the diagnosis is based, as has been seriously proposed by some surgical enthusiasts, on such slight grounds as a temporary pain and tenderness in the region of the appendix, then not one case in a hundred demands an operation. Benedict (Med. News, June 3, 1905).

Gradual remission of the active symptoms, especially in the size of the tumor, is a favorable sign. The contrary is the case when the remission is sudden.

Pain.—If violent, sudden, and persistent, it indicates probable seriousness of the attack, but nothing as to the natural defenses for limiting infection. On the other hand, absence of pain is undecisive between the gangrene and resolution.

Pulse and Temperature.—While a rapid pulse and high temperature favor the destructive process, their absence affords no assurance of recovery. Referring to this, Tyson remarks that too much stress cannot be laid upon the fact that there may be gangrenous appendicitis in the presence of normal temperature.

Shock.—The presence of shock, if undoubted, is a very grave symptom, generally indicating perforation. On the other hand, the most deadly attacks often occur without it.

Sensitiveness.—If persistent and highly developed, it generally indicates destructive inflammation, but gives no clue concerning the limitations of infection.

The Expression.—This is of material value before the development of grave conditions.

Perforation.—This can no more be foretold than the perforation of the intestine in typhoid fever or the rupture of an aneurism. Howard Crutcher (Canada Lancet, May, '98).

Tendency to recurrence is one of the marked features of appendicitis. The danger to life increases with each successive attack.

Study of 104 cases of recurring appendicitis in which operation between the attacks was performed, without a death. Examination of the appendices removed showed that in not one case had the organ become normal after the attack. Every specimen showed inflammatory conditions. Clinical symptoms are not certain, and one cannot positively determine from them the stage which the inflammation has reached nor the variety to which it belongs. Hermann Kümmell (Berliner klin. Woch., Apr. 11, '98).

Medical Treatment. — Medical treatment is indicated when the signs of abscess formation are not present and even then only during the incipient stage of the disease.

Saline aperient, sulphate of magnesia in small doses every two or three hours, combined with copious warm enemata or irrigation of the bowels with Hegar's funnel syringe, the patient being in the knee-chest position, are of value to reduce the infectious secretions and discharges.

For distension salines are of no use except very early; in appendicitis they

are decidedly injurious. Richardson (Amer. Jour. Med. Sciences, Jan., '94).

Purgatives are to be deprecated or utilized only when the local symptoms, the dangers of perforation and of generalized peritonitis, are less. Castor-oil in teaspoonful doses enough to begin on. Le Gendre, Sevestre, Moizard, Mathieu (La Semaine Méd., Nov. 28, '94).

For every case of appendicitis treated, at least five met with showing symptoms so closely resembling those of inflammation of the appendix that it was impossible to say that appendicitis did not exist until free purgation had been used.

In simple cases the cautious use of enemata to remove irritating intestinal contents to be preferred. Later on they tend to break adhesions by peristalsis, open perforative ulcers, and spread the infection. Schell (N. Y. Med. Jour., Apr. 20, '95).

Three cases in which rectal injections of large doses of glycerin were advantageously used. Joubert (Univ. Med. Jour., June, '95).

The diagnosis of pain in the abdomen, accompanied by fever, should be assisted by giving a purgative; in a number of cases this will lead to a rapid and complete cure. Mordecai Price (Med. and Surg. Reporter, Jan. 2, '97).

Out of 51 cases under personal supervision, 44 were successfully treated without operation. The method consists of at first giving cathartic doses of castor-oil with olive-oil, followed with hot water, until the bowels are thoroughly emptied. This is followed by enemas of glycerin and olive-oil. Flaxseed poultices soaked in olive-oil are applied to the abdomen. The diet is restricted to very light, easily digested foods. To prevent a return of the inflammatory process, after the original treatment ½ ounce of olive-oil is given, followed by a glass of hot water before each meal for several weeks. Terry (Medical Times; Canada Lancet, Mar., '98).

When pus is present, also when the symptoms are severe from the outset, and in relapsing cases without tumefaction one should operate. If operation is not performed, rest in bed, quiet, ice-bags, hot turpentine stupes, calomel,—the dose followed in six hours by magnesium sulphate,—or castor-oil alone are indicated. Diet should be light: broths with white of egg, milk in small quantities. No opium. Ninety per cent. of all first cases treated thus will recover, at least temporarily. M. C. McCannon (Medical and Surgical Bull., Aug. 9, '98).

Absolute rest is imperative, and only liquid food should be permitted.

For the pain, hot fomentations or poultices or the ice-bag may be applied over the cæcal region. If the ice-bag is used it should be shifted occasionally or removed at intervals.

It is bad practice to apply blisters and like remedies over the region of the appendix, when treating the disease, because, if operative measures are subsequently adopted, there will be more probability of suppuration and sloughing in the wound. O. W. Braymer (Jour. Amer. Med. Assoc., Apr. 23, '98).

Two cases of appendicitis in both of which undiluted ichthyol was painted over the ileo-cæcal region twice daily and ice-bags applied. In the graver of the two ichthalbin was exhibited internally as well. Both patients, when discharged, had no tenderness on pressure over the ileo-cæcal region. Action of the ichthalbin on the bowels was very beneficial. Fuchtenbusch (Amer. Med.-Surg. Bull., Dec. 25, '98).

Opium was at one time highly recommended, but it is now regarded by most clinicians as a dangerous remedy. It masks the symptoms, and thereby tends to compromise the chances of operative procedures through delay; it locks the intestines and thereby prevents the expulsion of infectious discharges.

Opium, by holding the bowels quiet, allows the pus to become incapsulated by adhesions. Kottmann (Corres. f. Schweizer Aerzte, July, '92).

Opium is the patient's greatest enemy; it masks the symptoms and renders diagnosis exceedingly difficult. J. T. Johnson (Med. News, Nov. 28, '96).

If opium has been given, it will be advisable for the surgeon to reserve his opinion, and if on withholding the sedative for a few hours the pulse has increased in frequency, and anxiety of countenance has declared itself, operation will be required. Mayo Robson (Brit. Med. Jour., Dec. 19, '96).

Opium paralyzes the nervous tone and resistance to microbic proliferation, and masks symptoms. It is doubtful whether it has ever checked peritonitis. Old fashioned laudanum poultice is sufficient in parietal cases. Surgical measures are required only in one-third of the cases and should always be preceded by medical treatment. Talamon (Méd. Mod., No. 31, '97).

Proper expectant treatment: Put the patient to bed and keep him there. Apply over the whole iliac region a soap "poultice," consisting of a thick layer of green soap, spread on a single layer of muslin or lint. Over this apply an ice-bag or ice-coil. Relieve bowels by soap-and-water enema. Keep the stomach at rest while vomiting exists. Restrict the patient to milk or clear broths. Note the temperature, pulse, and respirations every four hours. Give no drugs. Never give opium or morphine in cases of appendicitis, except in cases of abdominal shock from rupture of appendix or abscess. Syms (N. Y. Med. Jour., May 15, '97).

Fifteen cases of appendicitis in private practice, all of whom have recovered without operation. Patients were all put to bed and kept quiet. All food was withheld for twenty-four or forty-eight hours—even water was given sparingly. A saturated solution of Epsom salt in peppermint-water was given in teaspoonful doses, one in three hours, until one or two movements of the bowels were obtained in twenty-four hours. When stomach was too irritable to retain the Epsom salts, calomel was given in divided doses until there were one or two movements of the bowels. No opiates were employed. When patient began to eat, food was given cautiously: a teaspoonful of milk and lime-water, or small quantity of beef-juice or some animal broth, once in two or three hours. Turpentine stupes and the hot-water bags are of use in overcoming pain. Opiates are to be avoided. Many cases, however, are surgical from the beginning. The result of medical treatment is doubtful, if within the first twenty-four hours after the patient is seen, or after the bowels have been sufficiently moved, there has not been a decided improvement in pain, vomiting, and fever. H. B. Allyn (Ther. Gaz., Jan. 15, '99).

The treatment in the early stages of appendicitis should be as follows: 1. copious warm soap and water enemata should be given, with the object of evacuating the lower bowel. 2. The hourly administration, until the bowels move freely, of small teaspoonfuls of sulphate of magnesia dissolved in about 2 wineglassfuls of warm water. It usually takes from six to eight doses before the bowels commence to move. 3. Hot linseed poultices should be applied to the right iliac region for the relief of pain. Opium should be avoided on account of its tendency to mask symptoms and confine the bowels. 4. Whey, chicken-tea, meat-jellies, etc., may be given. Milk only encourages constipation. Ernest Maylard (Glasgow Med. Jour., Mar., '99).

The prophylactic diet treatment resolves itself into the avoidance of large, heavy meals, and particularly those which are hastily devoured. Milk is to be specially avoided, for it is a vehicle for bacteria of primary importance, and, further, produces bulky and scybalous stools. On the whole, a liquid and vegetable diet is the best to advise. Seymour Taylor (W. London Med. Jour., Apr., '99).

Nourishment only by the rectum during the acute stage of appendicitis prevents peristalsis and consequent irritation of the cæcum and its environment. This method enhances the patient's opportunity for recovery. If vomiting is present, gastric lavage will usually quiet it. A. J. Ochsner (Berliner klin. Woch., Sept. 24, 1900).

Opium is sometimes used in light cases where we are certain that no aggravation

of the condition present it to take place. But this no one can foretell with certainty, and it seems best to protect the patients against increased chances of death by only employing local anodyne measures that will not mask the advance of complications.

A large number of catarrhal cases are cured by medical treatment; but when the disease advances to pus-formation surgical treatment is needed. "If we err, let it be on the side of too early, rather than on that of too long delayed operation." Da Costa (Med. News, May 26, '94).

The surgeon is brought face to face with a condition which has a recognized mortality of about 5 to 8 per cent.: too high a percentage. We first have to contend with the presence of a suppuration. In 450 cases I do not think there has been an entire absence of pus in one single instance. I am satisfied there are some cases which can be cured by medicine, but can they be differentiated? By medical treatment we have a mortality of 10 per cent., and, if we have 3 per cent. by the knife, then we must operate to save the other 7 per cent. J. B. Murphy (Amer. Medico-Surg. Bull., Oct. 10, '96).

In a series of 517 cases the mortality was 23.8 per cent. in those of the cases treated in pre-operative days. Of the 517 cases, 389 were operated on and 128 treated without operation. In the latter the mortality was 3.12. Of 319, 81 were interval cases, in which there was 1 death. Of 305 operated on in the acute stage, 68 died. The great point in treatment is to anticipate the severer forms resulting in septic peritonitis by early surgical interference. Rule to advise operation at the end of twenty-four hours or thirty-six hours, if the patient is not improving. G. E. Armstrong (Lancet, Sept. 18, '97).

When a case of diseased appendix is personally seen operation is advised; if this is not assented to, all responsibility in the case is disavowed.

Early operation is admitted by all to be the proper course in the acute perforating peritonitis cases. In abscess cases it means small abscess easily and safely dealt with. In non-perforating cases it means avoiding all sorts of catastrophies to the patient, such as perforation, gangrene of the organ reaching the surface and infecting the peritoneal cavity, recurrence of the disease at a possible inopportune time, and last, but not least, cure of his disease. J. C. Davie (Dominion Med. Monthly, Nov., 1901).

Surgical Treatment.—Operation is indicated:—

1. When severe symptoms come on suddenly, either at the onset or during the course of the disease.

2. When in a mild case the symptoms are gradually increasing in intensity up to the third day.

3. When, by the third day, a firm, gradually growing mass can be felt at the seat of localized pain, and especially if there is localized œdema.

4. When abdominal distension, high pulse, diffusion of pain, and other evidences of general peritonitis come on at any time in the course of the disease.

By the second day, certainly by the third and *a fortiori* later, the operation should be done if the following indications are present: (1) if there is abdominal pain, most marked in the right iliac fossa, and especially with tenderness at McBurney's point, attended possibly with nausea and vomiting; (2) if there is rigidity of the right abdominal wall; (3) if there is fever up to 100° F., 101° F., or 102° F., which does not yield to medical treatment; (4) if by minute and careful palpation tumefaction and increased resistance can be discovered with possible dullness and, rarely, fluctuation; and (5) if there is œdema of the abdominal wall. W. W. Keen (Annals of Surgery, Apr., '91).

Experience of one hundred and eighty-one cases. Operation is called for immediately in a sudden severe attack of appendicitis with pain, vomiting, more or less distension, and high pulse, with

localized tenderness. In such a case the appendix is usually perforated and the bacteria are very virulent. Richardson (Amer. Jour. Med. Sciences, Jan., '94).

In entire personal experience not a death seen which could not properly be ascribed to delay in timely and skillful surgical interference. Every case from the very beginning should be treated by a surgeon, with a medical attendant. Wyeth (N. Y. Med. Jour., June 30, '94).

That some patients get comparatively well without operation no one denies, but usually improvement commences in such cases within from twelve to sixteen hours from the onset. On the contrary, if the symptoms become aggravated after this time or if the disease persists in spite of palliative measures (opium excluded), it becomes an operative case, and the physician or surgeon who hesitates to advise operation robs his patient of one of the best means known to science at the present day of saving life in this dreaded disease. J. C. Kennedy (Med. Record, Nov. 14, '96).

Estimate of the number of appendiceal patients who die under medical treatment, based on 100 consecutive personal operative cases. In that particular series the death would have been about 28 per cent. eventually.

One Hundred Consecutive Operative Appendiceal Cases.	Estimated Deaths Under Medical Treatment.
7 cases of tuberculosis and cancer	5
1 case of strangulation of bowels by appendix adhesion band.	1
38 abscess cases	15
8 cases with hard, incarcerated concretions	2
12 cases of occluding stricture dams	5
34 cases in common interval stages or in acute stages before advent of pus	0

The surgical death-rate in this series of 100 cases was 2 per cent. R. T. Morris (Med. Record, Dec. 26, '96).

1. A frequent or progressively accelerated pulse-rate of itself a prime indication for operation. 2. Pain localized and progressive is a valuable associated condition. When pain is sudden, severe, and progressive, and accompanied with chill, it means perforation or abscess, rupture, and operation. 3. Increase of temperature is third in importance, but when associated with one or more of the previous symptoms, and more especially with increase of pulse-rate, it makes immediate operation a foregone conclusion. 4. The gradual subsidence of the three cardinal symptoms — pulse-rate, pain, and temperature—is a legitimate reason for postponing immediate operative interference. 5. In cases of abscess it is generally safer, while watching for urgent indications, to wait until adhesions have formed a sufficiently protective wall. 6. In cases of recovery after mild attacks and without operation we are never sure of recurrence until the latter takes place, when the operation can be done soon enough, and, all other circumstances being equal, preferably in the interval of a succeeding attack, when the tissues are not in an inflamed condition. G. F. Shrady (Med. Record, Jan. 9, '97).

In appendicitis complicating pregnancy early operation on all but the very mildest cases recommended. 1. Within twelve hours in acute perforative cases. 2. A rapid pulse (116 to 120) is a strong indication for operation. 3. If doubt exists, operation. 4. If, after a sudden lull in symptoms, recurrence manifests itself, operation. 5. In recurrent attacks, during pregnancy, even if mild, operation indicated, especially in the early months of gestation. This removes the possibility of a future attack in the later months, when the procedure is more difficult. Abrahams (Amer. Jour. Obst., Feb., '97).

Views of a large number of representative surgeons on chief indications for operation: 1. Operation during the first twenty-four hours gives a mortality of 1 to 2 per cent., but 60 per cent. of these operations are unnecessary. 2. Operation only in very severe cases and for suppuration gives a mortality of 17 to 25 per cent. 3. Operation between these extremes gives a mortality of 14 per cent. Frederick Winnett (Canadian Practitioner, Mar., '97).

As soon as appendicitis is diagnosed, no matter how mild the case may be, an immediate operation should be performed, unless a patient is in severe shock following sudden perforation. In such cases the shock should be first overcome.

Series of 81 cases, all acute with 1 exception, all suppurative or gangrenous, and 4 complicated with peritonitis in which appendicectomy was performed with perfect recovery with 1 exception. Operation favored in the acute stage and as soon as diagnosis is made. Twice the appendix was found on the left side of the body; the cases were consecutive suppurative or gangrenous appendicitis. In all but 1 the appendix was perforated. Bernays (Med. Record, Apr. 2, '98).

Two cases of appendicitis in pregnant women operated on. Both cases recovered and neither miscarried. One should not hesitate to operate during any period of pregnancy, or even during parturition, if the case requires it. Hunter McGuire (Southern Med. Record; Canada Lancet, May, '98).

Case of successful operation for appendicitis during the eighth month of pregnancy; dermoid cyst with a twisted pedicle also removed. Twelve hours after the operation labor-pains set in and the woman was normally delivered of a live child. At time of report, just fourteen days after the operation, both mother and child are alive and well. A. G. Gerster (Annals of Surg., May, '98).

Operation advocated at the earliest possible opportunity in all those cases which have not shown definite signs of improvement within thirty-six hours. Suppuration occurs in a very much larger proportion of cases of inflamed appendix than is usually believed. In many of these the abscess bursts suddenly into the bowel with instantaneous remission of all the symptoms; in others the pus gradually becomes inspissated and dried up. It is true that many of these cases recover without operation, but it is not good surgery to leave an abscess in close proximity to the general peritoneal cavity in the hope that it will not burst into it.

Another argument in favor of early operation is the very grave effect upon mortality which the postponement of the operation exerts in the case of those who, because of suppuration or of diffuse peritonitis, come to operation at last. Fowler, analyzing 127 cases, showed that 83 per cent. recovered of those patients who were operated upon in the first three days; 60 per cent. of those operated upon on the fourth day; 58 per cent. of those operated upon on the fifth and sixth days; 50 per cent. of those operated upon on the seventh and eighth days; and only 33 per cent. of those operated upon on the ninth and tenth days. As Murphy has phrased it, one-half of all the patients who would have recovered by operation will die if we wait until the sixth day.

If in a case of inflamed appendix thirty-six hours have passed without definite improvement having shown itself, the responsibility for the consequences must, it seems, rest with those who recommend that an operation should not be performed. C. Mansell Moullin (Lancet, Dec. 16, '99).

At first, after a mild attack, resort may be had to the regulation of the diet and to salines. Should the attack be repeated, or should the first attack be a severe one, the appendix should be removed. Opium or morphine should not be given during an attack; neither should an operation be performed during an attack unless (1) a chill should manifest itself; (2) the pain should be severe enough to require morphine; (3) the pulse is small, rapid, or irregular; (4) there is persistent vomiting; (5) there is persistent rigidity of the abdominal wall; (6) an abscess can be felt; (7) the general condition makes it imperative; (8) in doubt. Joseph Wiener, Jr. (Med. Record, May 19, 1900).

Operation advised within the first twenty-four hours, since during that time it can be done with a maximum mortality of 2 per cent. The diagnosis can very readily be made within the first twenty-four hours. If the case is past the first seventy-two hours when first seen, it may sometimes be allowed to proceed without operation, if there is a circumscribed abscess with low tempera-

ture and no indication of great intoxication. J. B. Murphy (Chicago Med. Record, June, 1900).

Delay in operation is a common cause of fistula. There are two types, the external and internal, the former being divided into the simple and fæcal. The simple form of fistula is an external channel leading to an unhealed abscess, and corresponds to the drainage tract. This tends to heal spontaneously, and it is often due to some foreign body in the tract. A second variety of the simple fistula is where the lumen of the appendix is in direct communication with the tract. In these cases clear mucus is discharged, and the absence of fæcal matter is due to the fact that the inflammatory process has separated the cæcum from the appendix. J. B. Deaver (Jour. Amer. Med. Assoc., July 14, 1900).

Report based on the results of personal experience in 40 cases of acute appendicitis seen during the past year. In general peritonitis several cases recovered in spite of extensive involvement of the peritoneum in the inflammatory process: a feature attributed to abundant saline irrigation of the peritoneal cavity through a moderate incision without evisceration when wide-spread purulent peritonitis was present. There were 8 of these, 3 of which were fatal. Several of the patients who recovered not only presented the signs of severe sepsis, but the appearance of the interior of the abdomen was in several instances exceedingly unfavorable. Had the intestines been removed from the cavity and washed and wiped, the patients would not have recovered. This method of treatment in cases of purulent peritonitis condemned. The immediate effect is a severe strain upon the lowered vitality of the parts and subsequent paresis of the bowel is frequent. A. B. Johnson (Med. Record, Nov. 3, 1900).

A large number of athletes require the removal of the appendix. If we made it a practice to operate when the trouble is first recognized, without the delay of a day or more for consultations and for therapeutical treatment, the deaths would be very few. The so-called very "conservative" man gives us the ugly abscess class of cases, and the virulent, perforative cases. Joseph Price (Jour. Amer. Med. Assoc., Nov. 24, 1900).

The ideal time to operate in appendicitis to obtain ideal results is in the stage of appendicular colic, before inflammation has taken possession of the vulnerable tissues composing this organ.

Formerly abscess-formation was regarded as the indication for operation, certainly a most unfortunate view, for then the time for an ideal operation has passed.

An abscess-cavity must heal by granulation, cicatrization, and contraction. In appendicular abscess of any size the inner wall is formed by adherent loops of small bowel. During contraction the calibre of the bowel is often occluded, and acute mechanical obstruction results, which, unless relieved by immediate operation, must result in the death of the patient.

In personal experience at the German Hospital, where yearly from one hundred and fifty to two hundred operations are performed for acute appendicitis, many of which are of the abscess type, the percentage of intestinal obstruction is comparatively small. This condition, which usually does not occur for ten days, is so feared that, upon the appearance of paroxysmal abdominal pain, nausea, inability to pass flatus or to have the bowels moved by simple purgative medicines aided by high enemata through the rectal tube and given by hydrostatic pressure, and with the presence of slight tympany with paroxysmal pains provoked by gentle palpation of the abdominal wall, a section is immediately advised. By this practice recoveries are recorded in patients that otherwise would have perished.

It is personal practice in dealing with these large abscess cases not to be content with the evacuation of the abscess and the removal of the appendix, but, further, to relieve the adherent coils of bowel, which, done with proper manipulation, skill, and disposition of sterile gauze to guard against infection of the general peritoneal cavity, and the placing of gauze drains, prevents this

complication being more common than it otherwise would. Again, in these abscess cases it happens frequently that, in addition to the principal focus of suppuration, there are other foci. In such instances the evacuation of the primary focus of pus does not necessarily mean the evacuation of the secondary collections. This phase of treatment is one of the most important; overlooking secondary collections figures conspicuously in the mortality of this class of cases.

Where the appendicular inflammation has involved to any degree the neighboring structures, particularly the great omentum, as is so commonly seen in abscess cases, it is necessary to tie off the involved portion of the omentum, which frequently is partly or entirely gangrenous. The sooner the appendix is out, the better for the subsequent welfare of the patient. J. B. Deaver (New York Med. Jour., Dec. 7, 1901).

The conservative treatment of appendicitis consists in prompt operation. The starvation method of procrastination is vicious and has cost many lives, because it is used as an excuse to dally with patients that should be promptly subjected to removal of the organ. J. H. Carstens (New York Med. Jour., Jan. 18, 1902).

Almost every prominent surgeon in this country has insisted that if the case is seen within the first forty-eight hours it should be operated on, the sooner the safer the operation will be. The more experience the writer has, the more he is convinced that this is the proper course to pursue. If the inflammation is still confined within the appendix and the patient is still in a reasonably good condition, whether it is during the first forty-eight hours, or whether it is during the third, fourth, or fifth day, operation is indicated. There are, at least in Minnesota, a considerable number of cases brought to the hospital in which this favorable condition has gone by. The patient is tympanitic, vomiting, with quickened pulse, and we realize that no longer by removing the appendix can we get the material out of the system. Operation at this time will give a very considerable mortality. Cases that show this septic condition placed on the plan of treatment recommended by Dr. Ochsner will in a few days bring the majority into a condition in which they can safely be operated, with a mortality of 4 per cent. or less; at least this has been our experience. W. J. Mayo (Jour. Amer. Med. Assoc., Aug. 29, 1903). [See reference to Dr. Ochsner's paper, page 474.—Ed.]

Although formerly the writer used to forbid morphine altogether, his views on the subject have changed, and he now gives it cautiously in cases in which there is great restlessness. Both gauze packing and iodoform gauze have been abandoned altogether, as well as the use of buried sutures of silkworm gut. A standard length of one and one-half inches for the incision has been adopted for nearly all instances, including cases of abscess and peritonitis, and it has been found safer to deal with adhesions by touch than by sight. The time limit has also been greatly reduced, and now it is common to have the time from the first incision to the last suture occupy not more than seven or eight minutes. All patients are operated on, even if moribund, a preliminary infusion of salt solution being given; adhesions are freely separated if necessary, but not otherwise, and the idea of flushing out the abdomen has been dropped. After eliminating the features which seemed to have a special death rate of their own, viz., gauze packing, iodoform gauze, long incisions, and the expenditure of time in unnecessary detail of work, 100 consecutive operations were reported with a 2 per cent. death rate.

The author does not favor the removal of the normal appendix in the course of other operative work, and he now uses a cigarette drain in all cases in which pus and septic debris have been left in the peritoneal cavity. The dictum of operating as soon as the diagnosis is made holds good, with certain exceptions, but it is still a question what to do with patients who are convalescing from the attack. In interval cases it now seems best to operate only when, on palpation, the appendix is found to be the definite

seat of chronic infection or of adhesions which cause symptoms. R. T. Morris (Medical Record, May 27, 1905).

Aspiration of the abscess through the abdominal wall is only indicated when it is clearly superficial; otherwise the chances of striking the abscess itself are very small and the risk may be great. Large abscesses may sometimes be evacuated through the rectum.

Operative Technique.—*Incision.*—The incision that is generally preferred at present is that recommended by McBurney (see *b*, *colored plate*). It crosses an imaginary line (*a*) drawn from the anterior superior spine of the ilium (*D*) to the umbilicus (*A*) at the juncture of its middle and lower thirds, and thus overlying the diseased structures. The integument and aponeurotic structures are alone to be incised, the muscular fibres being separated by means of the scalpel-handle in a line parallel to their course. As a result, muscular action will rather tend to approximate than to draw apart the edges of the wound and thus prevent post-operative hernia: a condition frequently met with, especially when the median incision was generally used. The latter is still resorted to by some surgeons, and is especially useful when diffuse abscess is present.

The frequency of post-operative hernia has caused surgeons to greatly reduce the length of incisions, and Morris has shown that an opening through the muscular tissues $1\,^1/_2$ inches in length was sufficient in the majority of instances. McBurney has found that even in his method the opening in the deeper layers of the abdominal wall need not be more than two inches in length.

> Probably few appreciate the number of cases of hernia following this operation. Since April, 1895, there have been observed at the Hospital for the Ruptured and Crippled fifty-five cases. There was evidence that in many instances the wound was improperly closed. Perhaps in a large majority of the cases there had evidently been suppuration during the healing of the wound. Coley (Annals of Surg., Aug., '97).
>
> The beginner in surgery is inclined to make incisions that are too short, rendering his work more difficult and very likely incomplete. With the establishment of confidence in his resources, the tendency is to make freer and bolder incisions. The surgeon cannot do good work, particularly in abdominal surgery, if he begins his work with incisions that are too short. He cannot do the best work if he continues to make incisions that are too bold, or too free. After one has acquired a certain amount of skill in technique, he can return to the shorter incisions, which will allow the patient to escape with the least possible attack of incision. Even a bear has been known to die from too much incision, and in dealing with patients the incision is of some consequence to them. With long incisions there is more shock; more adhesions: 1. Because the exposure of the peritoneum through a long incision excites greater inflammatory reaction, and this results in more peritoneal adhesions, which must be disposed of, or which may remain to make the patient life-long trouble. 2. The longer the incision the greater the danger of infection from the aërial bacteria. With long incisions the patient's general resistance is interfered with. The author would make this statement, however, that the surgeon should make as long an incision as he feels is necessary, and by no means be guided by the idea that he is to conform to any length of incision. R. T. Morris (Proc. Southern Surg. and Gynæc. Assoc.; Med. Rec., Jan. 9, 1904).

McBurney recommended his method only for non-suppurative cases or those in which drainage was not required, but many surgeons employ it with advantage in almost all cases of appendicitis, including those in which an abscess is present and where drainage is required.

The McBurney method employed during the past year in all suppurative as well as non-suppurative cases. Without cutting muscular structures it is possible to separate the internal oblique and transversalis muscle fibres in an outward direction, so as to make a large enough opening to approach any abscess-cavity in the iliac fossa and perform necessary manipulation in suppurative cases, including ligation or treating the appendix as desired. In leaving an opening in the intermuscular space to permit drainage there was no trouble in subsequent healing of the wound. The natural tendency of the muscular fibres to draw together in the direction of their length approximated those which had been drawn out of their course, and permitted them to resume their function. As a rule, after granulation the wound unites in a fine, linear scar, without stitching. Abbe (Annals of Surg., Aug., '97).

For the prevention of ventral hernia McBurney's muscle-splitting incision recommended, even though pus be present; most of the wound is sutured and provisional sutures are placed which can be tied later. The early removal of drainage is a matter of great importance, the gauze drain is replaced by a shorter drain or by a drain of rubber tissue folded on itself like a fan. The removal of the appendix is advised when possible. The patients are kept in bed three weeks, and at the end of this time firm union is usually obtained. G. Woolsey (Med. Record, Apr. 1, '99).

Some operators have found that when the appendix is in the normal position and is not difficult to bring out, McBurney's method is almost ideal; but when difficulties arise and the incision has to be enlarged, the necessarily constant and hard retraction of the muscles is likely to injure the tissue and sometimes to cause suppuration. If it is necessary to enlarge the wound, there results a ragged and complicated wound, not well adapted to drainage if pus is found. The position of McBurney's incision is also thought by some to render proper drainage difficult to obtain. Other incisions are therefore resorted to.

The hypogastric incision (*f*) may be more or less near the spine of the ilium, beginning a little above the line drawn from the umbilicus to the spine of the ilium, or it may be made wholly below this line. At the outset it may be two inches in length, and subsequently be extended in either direction if necessary.

An incision proposed by Jalaguier and recently recommended by Kammerer is especially applicable to cases occurring in slim children. It is thought to prevent post-operative hernia better than any other. The skin and the aponeurosis of the external oblique are incised at the outer border of the rectus (*d*), and the aponeurosis on the inner side of this incision is then dissected for some distance from the anterior sheath of the muscle, and drawn toward the median line, exposing the sheath. An incision (*e*) parallel to the first is then made in the latter sheath about one-half inch to the inside of the border of the rectus, exposing the muscle. When the operation is finished, the deeper incision is closed and the rectus, permitted to slip in place, acts as protecting covering. Kammerer recommends it for adults.

Modified incisions have also been proposed by other surgeons, among which those of Elliott, Vischer, Willy Meyer, Fowler, and Weir may be mentioned.

To avoid the drawbacks of the McBurney incision a longitudinal cut is made through the skin and the aponeurosis of the external oblique, beginning one-half inch inside the anterior spine of the ilium, and extending to the linea semilunaris. The fibres of the external oblique are thus cut across, but the fibres of the internal oblique and transversalis are separated as in the McBurney operation. The wound is closed by passing two rows of sutures

through all the layers of the abdomen, to prevent a dead space, and uniting the cut edges of the external oblique with a continuous, buried, silk suture. No nerves or muscles are cut; there is no resulting anæsthesia of the skin. The aponeurosis of the external oblique has united well in every case. Elliot (Boston Med. and Surg. Jour., Oct. 29, '96).

To easily locate the appendix and facilitate free drainage, an incision is made through a more muscular and dependent portion of the abdominal wall an inch above and parallel to the crest of the ilium, beginning at the outer edge of the external oblique, and running forward to a point corresponding to the anterior superior iliac spine, or, if necessary, slightly beyond this. Having divided the skin and aponeurosis, the external oblique, which is found well developed at this point, and its fibres running nearly vertical, is separated, after which the internal oblique and transversalis, which are also well developed, and whose fibres run nearly on one plane, are separated, exposing the transversalis fascia. This, together with the peritoneum, is divided in a vertical direction. This will be found to have opened the peritoneal cavity at its lowermost plane and near to the attachment of the cæcum. A finger, now being introduced, invariably comes in contact with the caput coli, which can be readily drawn into the wound, and thereby facilitate the search for the appendix. In suppurative cases, the pus-cavity being opened at this point, drainage follows at the most dependent point. The greatest disadvantages are the depth of the wound and hæmorrhage from a small muscular branch of the circumflex iliac artery, which can readily be controlled. Vischer (Annals of Surg., Nov., '97).

"Hockey-stick" incision in appendicitis admits of the fibres of the oblique and transversalis being separated and not cut transversely; at the same time sufficient room is obtained, not only for the removal of the appendix, but for meeting any complications that may exist in the pelvis upon the right side. The incision begins above, midway between McBurney's point and the anterior superior spine of the ilium. It descends parallel with a line drawn from the pubis to the anterior superior spine, and, when above Poupart's ligament on a line with the femoral artery, curves at an obtuse angle and is extended as far as the border of the rectus muscle. In making the horizontal part of the incision care must be taken not to injure the epigastric artery. Willy Meyer (Jour. Amer. Med. Assoc., Feb. 17, 1900).

New method of opening the abdomen in cases of simple appendicitis: The skin incision commences at the upper rounded prominence of the anterior superior spine of the ilium and is carried almost horizontally to the outer edge of the rectus, from which point it is curved downward for about two and one-half inches. The triangular flap is then dissected downward and outward, exposing aponeurosis of the external oblique. A retractor is applied at the lower angle of the wound and at the middle of the transverse incision, and traction exposes three inches of the aponeurosis, which is divided in the direction of its fibres. Two more retractors are applied and the sheath of the rectus exposed likewise and opened. The rectus muscle and deep epigastric vessels are retracted medianward, exposing for four inches in a transverse direction the internal oblique and its aponeurosis. A transverse incision is now carried down through the remaining layers into the abdominal cavity, making a wound which by proper retraction gives ample room for an appendectomy. In closing the wound the different layers are closed by continuous sutures running in the lines of incision, care being taken in suturing the external oblique aponeurosis that the sheath of the rectus abdominalis is included. Fowler (Med. News, Mar. 3, 1900; Phila. Med. Jour.).

Method of operating on appendicitis by incising the external oblique fascia and then forcibly separating the muscles is so superior to the older method of cutting through the muscle in the prevention of hernia that it is the operation *par excellence* in many cases. It, however, does not provide sufficient room for the complicated cases, and the incis-

ing of the intermuscular space upward along the border of the rectus has proved unsatisfactory. Proposition to gain the necessary room by tearing the denuded fascia of the external oblique from the sheath of the rectus quite up to the median line. The anterior sheath of the rectus is there divided transversely in a line continuous with the opening made in the peritoneum by the original muscle-separation operation. The rectus muscle can now be retracted medianward and, after ligation or retraction of the epigastric vessels, the posterior sheath and peritoneum can be cut in a direction similar to the anterior sheath. The procedure allows the greatest access possible to the right iliac fossa. The sheaths of the rectus should be closed with catgut. R. F. Weir (Phila. Med. Jour., from Med. News, Feb. 17, 1900).

The abdominal walls having been penetrated, the margins of the wound are then retracted by an assistant, unless the abscess has already reached the surface. The peritoneum is then divided freely, but with great care.

Matted coils are gently separated and intestinal prolapse and contact with diseased surfaces are prevented by carefully packing the cavity around the cæcum with pads of iodoform gauze, the ends remaining outside or being held by clamps. This should be done in such a manner that no infected tissue or fluid be in any way brought in contact with the healthy peritoneum. The walls of the pus-cavity are then disinfected with a bichloride solution of 1 to 5000.

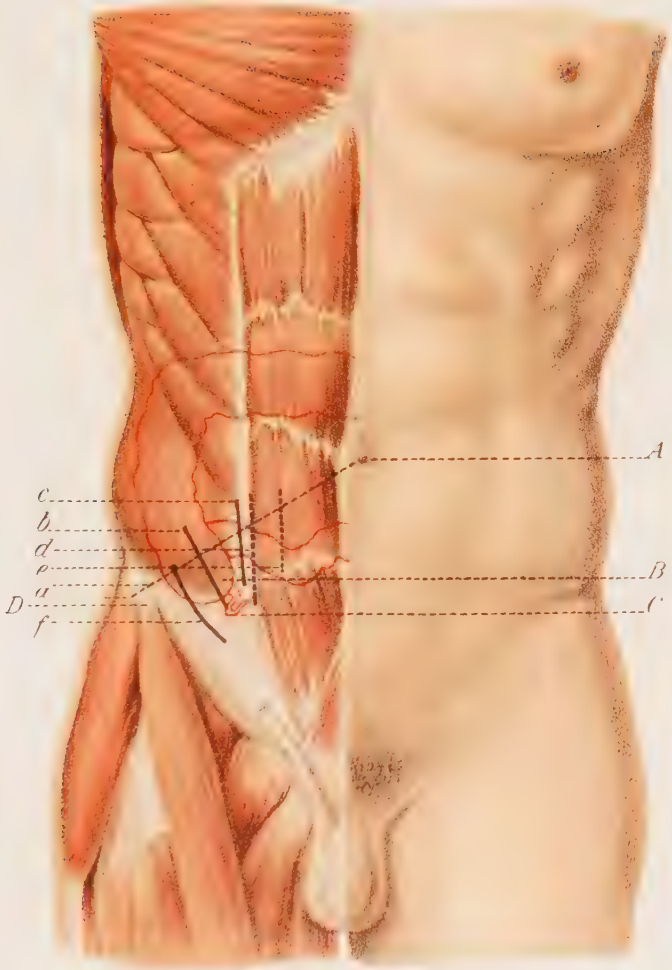
The cæcum being now isolated, it is important to also remove the cause of the abscess or its contents without causing septic material to invade the general peritoneal cavity.

If, in handling, any adhesions are broken through, it is quite easy for a coil of intestine which is not infected to enter the abscess-cavity through the opening made and to become at once infected, then rapidly disappear and reach a situation where it is entirely beyond control; or, if such an accidental break in the wall of the abscess have been made and a small quantity of the abscess-contents have escaped among the uninfected intestines, fatal infection may result. McBurney (Buffalo Med. Jour., June, '96).

But two incisions personally used for appendicitis: the gridiron, or McBurney incision, and the clean cut through all the tissues from the skin into the peritoneal cavity. The former should be selected when the conditions justify it; that is, in all clean cases, in those operated upon in the period of quiescence and in others when the inflammatory and septic processes are limited either within the lumen of the appendix or immediately about its walls and when there is no more than a limited local peritonitis. An incision shorter than three inches except in cases of well-marked abscess is not advisable. In this condition it is best simply to incise and puncture and drain the abscess. When a condition of sepsis prevails, such as to require a careful operation to prevent widespread infection and peritonitis, the writer prefers the clean incision through everything from the skin and including the peritoneum. The technique of both methods is given briefly. When the "gridiron" incision is used it may not be necessary to keep the patient in bed as long as when "through-and-through" incision is employed. J. A. Wyeth (Med. Record, June 7, 1902).

If the appendix is not readily found, the anterior longitudinal band of the cæcum is taken as a guide and followed until the appendix is encountered,—usually behind. In the annexed *colored plate* only the tip of the appendix shows; but the greater part of the organ lies behind the cæcum, its orifice in the latter being situated immediately under the spot where the McBurney incision (*b*) crosses index line (*e*).

When the abdominal cavity has been opened the exact position of the appendix can be found by following the white



Lines of incision in Laparotomy for Appendicitis.

A Umbilicus B Cæcum and termination of the Ileum C Vermiform Appendix D Anterior Superior Spine of the Ilium

fibrous bands along the convex surface of the cæcum to the base of the appendix. Murphy (Jour. Amer. Med. Assoc., Mar. 30, '95).

Experiments in operations and cadavers have shown that the appendix always rises from that point upon the cæcum where the three descending mesenteric bands join one another. Thus by following the anterior broad band, down the cæcum, through adhesions, exudates, etc., the appendix is invariably discovered. P. Mueller (Centralb. f. Chir., July 6, 1901).

The possibility of an anomalous conformation or position of the appendix should be borne in mind.

In but three instances out of one hundred and forty-four operations for diseases not connected with the appendix was the appendix found outside of the peritoneal cavity. In sixty-six examinations 40 per cent. of the appendices were free; in that number one-half of the entire length was surrounded with peritoneum. Joseph D. Bryant (Mathews's Med. Quarterly, '94).

Case in which tip of vermiform appendix was found in contact with the under surface of liver. Bland Sutton (Med. Press and Circular, Oct. 10, '94).

In two cases the appendix was found attached to the left Fallopian tube and bound up in an adherent mass on that side. In a great number of cases the appendix is adherent to the Fallopian tube on the right side. Porter (Berliner klin. Woch., Sept. 4, '95).

In one hundred and fifty cases of post-mortem examinations the length of the appendix varied from 2 1/2 to 9 3/4 inches. Only two came above the general measurements: one 6 1/2, and the other, the longest the author has been able to find any record of, 9 3/4 inches. Both of these extra-long appendices were found in males. C. J. Ringwell (Med. Record, July 18, '96).

Case in which the cæcum was found well toward the median line; the appendix was lying directly across the abdominal cavity, bound to the omentum in the left iliac fossa. M. M. Franklin (Univ. Med. Mag., Oct., '97).

If the appendix contain a concretion or foreign body, or is enlarged, perforated, or otherwise abnormal, it should be tied close to the cæcum, then cut off below the ligature. It is sometimes found detached and necrotic.

If there is a circumscribed abscess, it is poor surgery to insist, in every case and at every period, upon finding and taking away the appendix in the face of all obstacles. In many cases of circumscribed abscess, and especially in those in which the appendix is bound down by adhesions in the depth of the wound, the surgeon should be content with evacuation, irrigation, drainage, and packing with iodoform gauze. Persistent search for the appendix and attempts at its removal in these cases are attended with such danger of opening the peritoneal cavity that they are not to be recommended. (J. William White.)

There are some cases, not few in number, in which the appendix is so deeply imbedded in the wall of the abscess, or so difficult to define at all, that to insist upon its discovery and complete removal would be to incur quite unjustifiable risk. One had better be content with properly evacuating, cleansing, and packing the cavity, leaving the appendix or its remnant to be disposed of by its obliteration in the wound-healing, or by its removal at a later and more favorable time through a second operation. McBurney (Univ. Med. Mag., Mar., '96).

It has been my practice to carefully evacuate and cleanse by dry sponging with sterilized or iodoform gauze the pus-cavity; then to disinfect its walls with a bichloride solution, 1 to 5000; and then to search for and remove the appendix in case it be readily found and easily separated from the adhesions. In general, I have found this feasible in cases operated on up to the seventh or tenth day. In cases operated on at a later date, of those where the abscess is distinctly circumscribed with firm

walls and containing several ounces of pus, I have not attempted to remove the appendix. Bull (Univ. Med. Mag., Mar., '96).

It has been my habit for years in cases of acute appendicitis with extensive suppuration to simply incise, disinfect, and drain the abscess, unless the diseased appendix could be removed without any additional risk. I have seen a number of such cases recover permanently without any additional surgical interference. I regard persistent search for the appendix in such cases hazardous, as it often results in opening of the free peritoneal cavity and fatal septic peritonitis. Senn (Univ. Med. Mag., Mar., '96).

In cases of appendicitis in which the appendix is found to be densely adherent, or when it opens into an abscess, or when there exists a more or less general peritonitis, the operator dreads all avoidable contamination of the surrounding tissues with any part of the appendiceal abscess, and all avoidable injury to the coats of the adherent intestine. When the appendix is diseased and densely adherent at its tip, the best plan often is first to seek out and expose its base, which is detached and divided so as to free the appendix from the cæcum. The distal portion is now wrapped for protection in gauze, while the opening into the bowel is closed. Then the severed appendix is dissected out of its bed with much greater facility than was possible with both ends anchored, one to the cæcum and one to the adhesions. This plan of procedure is especially useful in the gynæcological field. In cases in which the vermiform appendix is attached to a pyosalpinx, or an ovarian or fibroid tumor, after it is severed from the bowel, it can then be enucleated with the pelvic abscess or with the tumor. When the end of the appendix enters the abscess cavity surrounded by the adherent intestine, which cannot be stripped off with safety, after freeing the base of the appendix from cæcum it was traced up until it entered an abscess-cavity under the ascending colon. It could not be separated from the adhesions without injuring the bowel, so the appendix was grasped with a pair of forceps, on either side, close to the abscess, and split open and followed to its lumen, as a guide, by using a grooved director and a pair of open scissors, with one blade in the appendix. The operator was thus enabled with certainty to enter the very middle of the abscess-cavity, and to lay it open and cleanse it without doing any damage to the colon. H. A. Kelly (Phila. Med. Jour., from Amer. Medicine, Apr. 20, 1901).

In case of general infection of the peritoneum the best technique consists in thorough irrigation with salt solution by means of tubes so contrived that the current is directed toward the incision. The writer advocates the establishment of drainage in the lumbar region and advises the use of 1 in 2000 bichloride gauze. He believes eventration and scouring under any conditions whatsoever to be a most unsurgical procedure. G. R. Fowler (Proc. Amer. Surg. Assoc.; Med. News, May 16, 1903).

The stump is either simply disinfected or the mucous membrane of cut surface cauterized with carbolic acid or cautery. The latter procedure is generally unnecessary, however. If the tissues about the base of the appendix are nearly normal, it is better to invert the stump and close it with two or three Lembert sutures.

The methods of dealing with the stump at present employed are far from perfect. After removing the appendix a continous Lembert suture should be run around the appendix like a purse-string. The appendix is then divided, leaving the stump never shorter than one-half inch. The stump is then invaginated,—turned "outside in," as a glove-finger,—the appendix end thus being inserted one-half inch *inside* the cæcum. Dawbarn (Inter. Jour. of Surg., vol. viii, No. 8).

In whatsoever manner treated, the stump remains as an excrescence, with chances of adhesions. To eliminate these, inversion into the lumen of the large intestine of either the entire appendix or any part remaining attached to the caput coli is recommended. Ede-

bohls (Amer. Jour. Med. Sciences, June, '95).

Inversion of the uncut appendix obviates the necessity of opening the bowels and avoids the risk of infection. Personally practiced in more than one hundred cases. In performing the operation the appendix is freed from all adhesions and brought into view in the usual way. The tip of the appendix is held by an assistant, who with the thumb and forefinger of the other hand supports the colon edges below the origin of the appendix. The ligature is then introduced and the meso-appendix ligated, which is then severed just beyond the ligature. The appendix is then freed of its peritoneal coat. The appendix, having thus been prepared for inversion, is seized between the thumb and forefinger of one hand and inverted by pressing upon it with the blunt end of a needle. The mucous membrane having been inverted for some distance, the needle is substituted by a long probe, which easily completes the inversion. A single stitch is then taken, closing the opening in the bowel, which then marks the point of opening of the appendix. In a few cases in which operation is made for appendicitis inversion is impossible or so difficult as to be unwise. These cases include gangrene of the appendix and those in which there is a constriction near its base. J. F. Baldwin (Med. Record, Jan. 20, 1900).

The writer applies two ligatures, one silk and one catgut, to the appendix, and then, after loosening the mesentery as far up to the cæcum as possible, transects between them. The stump's mucous membrane is then removed with curved scissors and the muscular coat and serosa are united with three silk sutures. After removing the catgut ligature, three silk sutures are passed through cæcal serosa and muscularis, the surfaces thus approximated being about one-half centimetre wide. This is further strengthened by means of six or seven catgut sutures. The stump, which is made in this manner to lie in the cæcum, thus drops its silk sutures into this cavity. Riedel (Zentralb. f. Chir., Dec. 19, 1903).

Drainage is to be maintained until healing is shown to be taking place from the bottom of the wound. Gauze is to be used not only for the purpose, but quite as much to stimulate the adhesions between coils of intestine which surround it and to shut off the general peritoneal cavity from the infected portion. (Halsted.)

> Analysis of twelve hundred and thirty-six cases of appendicitis operated on in the Massachusetts General Hospital and examined some time after operation. Many of the cases which reported themselves as perfectly well had marked general bulging of the abdominal wall on the side operated upon. Some had protrusions of the wound, and some had hernias of which they were not aware. Intermuscular spaces could be detected in 28 per cent. of those with tightly closed wounds. These were present in 83 per cent. of those cases with wounds tightly closed and 87 per cent. of those which were left open. These intermuscular spaces result from separation of the muscles which were not brought into apposition by sutures. Drainage by gauze or by other means favors this condition, as do also transverse incisions of the muscles. The muscular and tendinous fibres should not be cut in any appendix operations if it can be avoided. When drainage is necessary, as much of the wound should be closed as possible with sutures, and the drainage removed at the earliest moment consistent with safety. Stout belts and trusses are of little value in the after-treatment of these cases, and may even do harm. The abdominal muscles, from the earliest possible period after the operation, should be developed with proper exercises. If hernia or marked bulging occurs, an operation for radical cure is safe and satisfactory. F. B. Harrington (Boston Med. and Surg. Jour., Aug. 3, '99).

It is important to withdraw the gauze plugs by rotary movement rather than by direct traction; it causes less pain. The patient should be revived from the shock of the operation as early as pos-

sible by an enema of hot coffee or whisky. (Abbe.)

> Two cases in which a circumscribed abscess was drained, and a sinus persisted until the appendix was removed, some months later. Removal of the appendix performed through an incision parallel to one internal to the original one. The sinus, unopened, was followed down to the appendix, which was removed after the healthy parts had been carefully walled off. All sinuses in the neighborhood of the appendix should be approached in this way. It is easier to prevent infection of the peritoneum if the cavity be freely opened so that the healthy parts may be protected and the situation of the appendix defined, than if the surgeon attempts to follow the sinus from the first, not knowing exactly where he may open the peritoneal cavity. Collins Warren (Boston Med. and Surg. Jour., Oct. 28, '96).

Remote Abscesses. — While the majority of abscesses are found in the appendicular region, others may occupy areas quite remote from the latter. To properly locate such an abscess is of great importance. When their evacuation becomes necessary the selection of the best point for incision is in order. This subject is graphically portrayed in the annexed colored plate prepared from sketches and an interesting paper published by Dr. M. L. Harris.

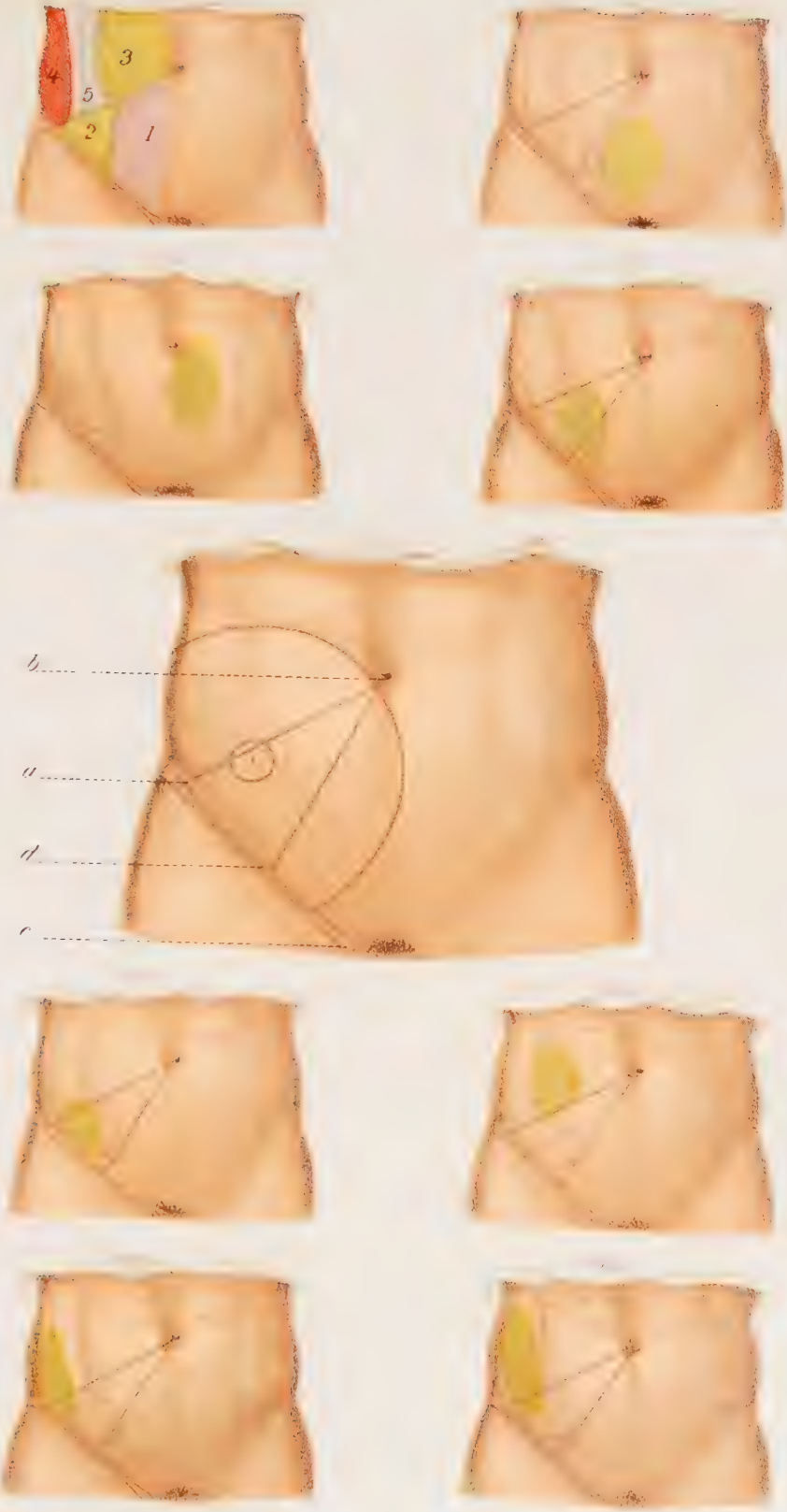
Description of Colored Plate on the Location of Appendicular Abscesses.— A circle of an inch and a half in diameter,— the size of a silver dollar,—drawn about the centre of the posterior surface of the cæcum, will touch the base or point of origin of the appendix in about 96 per cent. of all cases. It will thus be seen how constant is the location of the base of the appendix. The average length of the adult appendix is nine centimetres, or three and one-half inches. A circle then, of four-inch radius, drawn about the same centre as the smaller circle, will give a very large area in the abdominal cavity, anywhere within which the apex of the normal appendix may be found located. (See Fig. 1.)

The space within the large circle (see Fig. 2) may be subdivided into five separate areas (marked 1, 2, 3, 4, and 5), each having distinct and well-defined boundaries. The appendix may be found in any one of these areas, and, when an abscess forms about the inflamed organ, it is the particular area in which the appendix is located which gives the abscess or exudate its characteristic location and outline, which limits its extension in one direction and favors it in another, and which should guide us in the selection of the best point for incision.

Area 1: *Infra-mesenteric.*—The appendix is met with in this area in about 60 per cent. of the cases, either superficially situated, approaching anteriorly, or lying deeply on the posterior wall; it may extend directly inward, hugging the under surface of the mesentery at the ileum, or inward and downward, reaching often into the true pelvis. The mesentery above prevents the extension of abscesses in an upward direction, but gives them a tendency to extend forward and to the left.

The pelvic abscesses are limited in the male anteriorly by the bladder, posteriorly by the rectum and pelvic wall and above by the sigmoid and loops of small intestine. In the female they fill Douglas's *cul-de-sac* or occupy the ovarian region on one or both sides, where they are often with great difficulty differentiated from pelvic abscesses of tubal or ovarian origin. The danger of infecting the general cavity on opening these abscesses from above is very great, and the advisability of draining through the vagina in the female, as in other septic pelvic troubles, comes into serious consideration.

The inter-intestinal abscesses (see also Figs. 3 and 4) are usually situated near the median line, and are consequently best opened at this point. Adhesions may limit them, or there may be no adhesions and the free peritoneal cavity must be traversed to reach the abscess, after packing with iodoform gauze to prevent diffusion of pus. It is often impossible to prevent pus escaping into the general cavity, with a resulting fatal acute septic peritonitis. It is in those cases that the advisability of doing a *deux temps* operation should be considered. Should the appendix be found floating free in the abscess-cavity it may be removed, but if it be firmly imbedded in the exudate forming part of the abscess-wall it should, under no circumstances, be torn out



Location of Appendicular Abscess. (M L Harris.)

a Anterior Superior Spine of the Ilium b Umbilicus c Symphysis d Poupart's ligament

and removed, if by so doing we endanger breaking into the general cavity, thus leading to general sepsis.

The exudate may also come to the surface, forming adhesions to the anterior abdominal wall, just internal to the cæcum. (See Fig. 5.) The abscess is limited externally by the cæcum and internally by the loop of ileum which almost always covers over the end of the cæcum and the omentum. It is usually best opened by a vertical incision over the inner border of the cæcum. Care should be taken not to separate the loop of intestine internally, particularly at its lower angle, as pus then escapes at once into the pelvis. The appendix can nearly always be removed, as it usually lies posteriorly or anteriorly, and it can be done without disturbing the internal wall of exudate which protects the general cavity.

Area 2: *Retro-cæcal.*—Abscess is met in this area (see also Fig. 6) in about 23 per cent. of the cases. The appendix lies in the little pouch posterior to the cæcum, more or less curved or folded upon itself or extending downward and outward.

It is best opened by an oblique incision parallel to the outer half of Poupart's ligament, coming down upon the outer border of the cæcum, which should be raised up and turned inward. The appendix can nearly always be removed, unless it should be too firmly imbedded in the exudate forming the inner wall.

Area 3: *Supra-mesenteric.*—Abscesses here (see also Fig. 7) have a tendency to spread toward the liver and duodenum. The appendix lies above the mesentery of the ilium and internal to the inner layer of the mesocolon.

These abscesses are best reached by an incision along the external border of the right rectus muscle, great care being taken not to break down the adhesions between the loop of small intestine to the inner side. (See incision *c* in first colored plate.)

Area 4: *External.*—This is the space between the outer border of the colon, with its outer layer of mesocolon, and the external abdominal wall. The appendix may extend upward and outward into this space, its tip sometimes reaching nearly to the under surface of the liver. Abscesses spread to the liver and have repeatedly ruptured into the pleura and even into the bronchi. (See Fig. 8.)

They may be reached by an oblique incision extending from above the crest of the ilium downward and inward, parallel to the outer third of Poupart's ligament; or, if the abscess is high up, by a longitudinal incision over its most prominent part, care being taken to not injure the ilio-hypogastric nerve. The appendix can nearly always be removed, as there is no danger, in separating the adhesions about it, of opening the general cavity.

Area 5: *Retro-colonic, or Extra-peritoneal.*—In the cellular space posterior to the colon between the two layers of the mesocolon. (See Fig. 9.) Abscesses here are entirely extraperitoneal. The colon is pushed forward.

The incision in these cases should be an oblique one, similar to the one described under the fourth area, but extending pretty well above the crest of the ilium. M. L. Harris (Journal of the Amer. Med. Assoc., Dec. 21, '95).

> In retrocæcal suppurative appendicitis an incision recommended along the external border of the sacro-lumbar mass of muscle, and extending forward at the lower extremity parallel to and at a distance of about an inch from the crest of the ilium to within a distance of about an inch and one-fourth from the antero-superior iliac spine. The signs of retrocæcal abscess are the following: Tenderness over the triangle of Petit; but little, if any, pain at McBurney's point; marked fullness in the right flank; and a clear sound on percussing the right iliac fossa. If the appendix be found on one side or in the front of the cæcum, it may still be readily exposed by this incision. The situation of the wound permits perfect drainage and tends to secure the patient against the subsequent risk of hernia. Grinda (Méd. Mod., No. 71, '97).

Out of a total of 600 cases of appendicitis (350 with abscess-formation) in Sonnenburg's hospital and private practice, the complication of subphrenic abscess was met with in 9. In 6 of these the appendix and cæcum were displaced beneath the liver; so that the suppuration passed directly into the subphrenic space, extraperitoneally in 1 case, intraperitoneally in the majority. Pyothorax was also present in 6 cases; there was dry pleurisy at the base of the lung and of the diaphragmatic pleura in 2 cases.

The subphrenic abscess is easily opened and drained when it comes to the front below the costal margin; when it develops posteriorly, it must be approached by the transthoracic route. The rarity of subphrenic abscess in so large a number of cases of appendicitis is ascribed to the treatment of the latter by operation at a relatively early period of the disease. Körte has operated on 35 cases of subphrenic abscess, no less than 16 of which were the result of appendicitis. Weber (Centralb. f. Chir., Mar. 10, 1900).

Diffuse Abscess.—If an abscess has opened into the peritoneal cavity, causing diffused septic peritonitis, a good-sized incision is made parallel to the border of Poupart's ligament, the peritoneal cavity is opened, and the contained fluids are removed. The appendix is removed; further collections of fluid are looked for and withdrawn with a sponge on a handle. The cavity is washed out with a saline solution and drainage is provided for by a glass tube with a capillary gauze drain. The wound is left open, but no suturing is practiced. Nutrition by rectum for a day or two. The deep packing is not disturbed for four days. (McBurney.)

In twenty-four cases treated by the above procedure fourteen recoveries obtained. McBurney (N. Y. Med. Record, Mar. 30, '95).

Relapsing Form.

Symptoms.—The symptoms of an exacerbation are the same as in the acute form. The simple catarrhal form may be suspected when the recurrences happen more than four or five times, and last not more than a week and no tumor is felt.

The ulcerative form with its attending danger of perforation may be suspected when a tumor is felt in the interval, and especially when the tumor has increased in size during the access.

In fifty-seven cases of simple appendicitis, fifty-two showed appendicular perforation with abscess of surroundings. In eighty cases twenty presented at least one previous attack. Mathieu, Sonnenburg (Gaz. des. Hôp., Dec. 18, '94).

Perforation the rule in recurrent cases; the adhesions rupture, often without giving any sign, the patient dying of subacute peritonitis. Several instances in cases supposed to be cured. Broca (Bull. de la Soc. Anat., Dec., '94).

Etiology and Pathology. — The large majority of the attacks are due to any cause which may awaken the latent catarrhal process resulting from a previous attack treated medically. The pathological characters are the same as in the acute form, except in the fact that adhesions are likely to be found if anything but a very mild attack has previously occurred.

There is a class of cases, "appendicitis obliterans," a comparatively frequent relapsing form, which is characterized by progressive obliterations of the lumen of the appendix. Ribbert found in four hundred post-mortems (death being due to other causes than appendicitis) partial or complete obliteration in 25 per cent. Senn (Jour. Amer. Med. Assoc., Mar. 24, '94).

Instances in which there is only one attack are much more numerous than those in which there have been several attacks. The great majority of those who have passed through the stage of suppuration are rendered free from further attacks. Treves (Brit. Med. Jour., Mar. 9, '95).

After one attack the appendix is frequently as fully capable of originating another attack. Stimson, Bryant, Fowler (Annals of Surgery, May, '95).

1. The chief agents in producing relapsing or recurrent appendicitis are micro-organisms latent in the thick walls of the vermiform appendix, in the strictures, and in the cicatricial tissue, and adhesions both peri-appendicular and parietal.

2. Alteration and enfeeblement of the walls of the appendix; as by infiltration of fat, and new formation and dilatation of vessels, which readily favor both act-

ive and passive congestion or add to the results.

3. Certain appendices, apparently "healed," have some abrasion of the mucous membrane, which easily explains the presence of bacteria in the tissues, and by their development a reinfection is occasioned. Ch. von Mayer (Revue Méd. de la Suisse Rom., Apr. 20, '97).

In almost all chronic cases unattended by abscess or inflammatory adhesions, there is, first, a bend, or flexure, of the appendix; second, at the point of flexure there is also a stricture; and, third, distal to the stricture is marked distension of the appendix and great thickening of its walls. Supposing that the bend in the appendix is the first step in appendicitis, the bend embarrasses the escape of contents. To empty itself, the muscular walls are compelled to perform extra work, producing a very marked muscular hypertrophy. As a result of the pressure caused by the effort of the appendix to empty itself, the mucous coat at the point of flexion becomes eroded and inflamed, and functional stricture finally terminates in an organic stricture. This gives rise to recurring attacks of pain, which ceases when the appendix has discharged its contents. After a time, the organ is no longer able to empty itself. Distension, perforation, and peritonitis then follow. D. P. Allen (Med. Record, June 5, '97).

Forty-five cases of appendicitis complicating pregnancy, diagnosis being confirmed in thirty by operation or post-mortem. It is concluded that: 1. Appendicitis may attack a pregnant woman at the beginning or at any time during pregnancy in the puerperium. 2. In most cases it causes abortion. The child dies, as a rule, very rapidly from infection. 3. It is only possible to save both mother and child when the abscess is limited and encysted. 4. Every type of appendicitis may occur. 5. The diagnosis may be difficult, owing to the enlarged uterus, or still more so during the puerperium, but is usually possible with care. 6. Treatment consists in operating as early as possible. A preliminary induction of premature labor is unjustifiable, since pregnancy is not always interrupted if the mother recovers. 7. Prophylaxis consists in operating in every case of relapsing appendicitis in a young girl or non-pregnant woman during the period of sexual activity. Pinard (La Sem. Méd., Mar. 23, '98).

Prognosis. — The chances that a first or second attack of acute catarrhal appendicitis will be renewed are about 77 per cent.; but, when a fourth or a fifth attack has occurred, the probability is very great that more will follow and ultimately end fatally, unless operation is performed.

After the patient has gone through an acute attack safely, and the characteristic tumor indicating an acute suppurative process is felt, a circumscribed peritonitis, rather than a general suppurative one, is likely to occur if another attack takes place.

Analysis of 50 cases of recurrent appendicitis operated. Thirty-nine were males and 11 were females. Twenty-three occurred in persons between 20 and 30 years of age. The youngest patient was 10 and the oldest 53 years of age. In only 5 patients had there been but one distinct attack. In almost every case the lumen of the appendix was either partially or completely occluded at some point in its course. In 6 cases fæcal concretions were present, but in no instance was any foreign body found. All recovered. Southam (Brit. Med. Jour., Jan. 10, 1903).

Surgical Treatment. — This is indicated when the relapses are frequent and increasing in severity, and when a tumor is present during the interval, the presence of septic accumulation, ulceration, or perforation being likely. It should be performed during a period of quiescence in the manner described in the preceding pages.

In relapsing cases the operation should be performed between the attacks. Roux (Revue Méd. de la Suisse Rom., Sept., Oct., Nov., '91; Jan., '92).

The general consensus of opinion favors operation, both in latent cases with relapse and those which are accompanied by a general purulent peritonitis. Réclus (La Semaine Méd., June 22, '92).

Prompt surgical interference during the interval between the attacks is an advisable and safe procedure. The physical characteristics define clearly the situation of the appendix. Bryant (Jour. Amer. Med. Assoc., Nov. 3, '94).

Fifty-one cases of recurrent appendicitis operated during intervals between attacks, with but one death. Conservatism should be observed, however, about operating during an acute attack. There is no distinction between simple appendicitis and appendicitis with perforation, as far as operative indications go. Kummel (Le Bull. Méd., Oct. 6, '95).

Four cases of chronic appendicitis, in each of which operation was clearly indicated and had been advised by several eminent surgeons, successfully treated by "tonic" doses of protiodide of mercury. Horwitz (Annals of Surg., Jan., '98).

The most suitable time for operation is about three weeks after the commencement of the attack, when all acute symptoms have disappeared and the temperature and pulse have become normal. G. Barling (Brit. Med. Jour., Jan. 29, '98).

Conclusions are that in all cases of appendicitis during the first attack, operation should not be performed unless suppuration or diffuse peritonitis requires it. In lapsing or recurrent cases, in which it is probable that distortion or other permanent injury to the appendix exists, one should operate. E. D. Ferguson (N. Y. Med. Jour., Mar. 26, '98).

According to Czerny, the first acute attack of appendicitis belongs to the physician. This attack may: (*a*) pass by without complication, in which case there is no occasion for surgical interference; or (*b*) earlier or later, with alarming symptoms of general or local nature (fever, rapid pulse, pain, dullness on percussion, rigidity), it may go on to perforation and abscess-formation. Such an abscess either (*A*) leads to progressive and threatening general peritonitis or (*B*) it remains circumscribed and becomes incapsulated, the first severe symptoms continuing without important change. The conditions (*b*), (*A*), and (*B*) indicate surgical treatment, as do all chronic recurrent forms of appendicitis, whether they be purely catarrhal, ulcerative, perforating, or obliterative. Editorial (Phila. Med. Jour., July 9, '98).

After-treatment of the Various Forms.—The patient should not leave his bed until the subsidence of all trace of inflammation and until proper healing of the wound have taken place, namely: from three to five weeks. Otherwise there is great liability to recurrence or relapse.

The after-treatment is important and should be conducted with great care. The stomach should be given complete rest for twelve hours, cracked ice and water being allowed in moderation. After that, liquid food, beginning with peptonized milk, if there is any tendency to nausea or vomiting, may be given. To keep the intestinal tract as clear as possible, a daily injection of lukewarm soap and water is sufficient. The patient should lie on his back the first four days, then begin to change his positions in bed, if he desires, without violence. Opium should be given in small doses: just enough to check peristalsis.

The outside dressing should be changed every day at first, and the packing removed on the fourth or fifth day after operation. This should be done with great care and the cavity cleansed by dry sponging, no fluids being introduced into the wound. The wound is then repacked and left so three days, and renewed when necessary. As the packing is renewed from time to time, it should be reduced in size at each sitting so as to permit the wound to heal from the bottom.

Apart from the actual tearing of adhesions or bowel by violent exercise, it is clear that great exertion or strain before the adhesions are properly organized and

tough might lead to their stretching so as to form elongated bands, which may subsequently tend to intestinal obstruction.

It is therefore obviously prudent to impress upon patients the necessity for moderation in violent exercise for at least one year from the time of the operation. William H. Bennett (Clinical Jour., Sept. 7, '98).

After a second catarrhal attack the operation for removal of the appendix when possible ought to be done after all acute symptoms have subsided, and after the patient has been carefully prepared for it. The diet for four days ought to consist of soups, barley-water, and white meats, avoiding milk and starchy foods. The bowels should be regulated so that they are thoroughly moved the day before operation. The usual arrangements for the preparation of the skin are carried out, 3 ounces of soup with a tablespoonful of whisky are given as a nutrient enema three-fourths of an hour before operation, and a subcutaneous injection of $^1/_{80}$ grain of strychnine which materially diminishes shock, and this may be repeated in the middle of the operation if necessary. An incision, varying in length from 2 to 3 inches according to the stoutness of the patient, is made on the outer side of the rectus muscle over McBurney's point, dividing skin and fascia, the muscles are then separated, not cut, and the peritoneal cavity carefully opened in the usual way, a small sponge with string attached is introduced into the abdomen, all small vessels are then tied in order to get rid of the pressure-forceps in the neighborhood of the wound, as they might bruise the bowel if it requires to be drawn out in the process of separating the appendix. Removing the sponge from the abdomen, the appendix is found in connection with one of the longitudinal bands passing downward, inward, or backward, and, with care, it is separated. At times it is so adherent that it is wiser to leave it alone and trust to the effect of the exploratory incision. Having separated the appendix and tied its mesentery, it is removed.

The after-treatment of patients who have had this operation performed is the same as is used in other abdominal cases. The patient is to be gently kept under the influence of morphine for two days, and only soups and barley-water (starvation diet) are to be given. After the bowels have been moved on the sixth day, a more generous diet is allowed, and in three weeks the wound will be firmly healed, and the patient be allowed to be on the sofa wearing an elastic bandage. At the end of the fourth week, if the wound has been small, walking about moderately is permitted, and gradually the patient resumes his ordinary work. Generally great improvement in health follows this operation. J. C. Renton (Brit. Med. Jour., May 25, 1901).

William B. Coley,
New York.

ARGONIN. — Argonin is a soluble silver-albumin salt prepared by mixing sodium-casein with silver nitrate and adding alcohol until precipitation occurs.

Argonin appears as a fine white powder, soluble in hot water, but slightly so in cold.

Physiological Action.—When applied locally it is non-irritant and does not coagulate the albumin of the tissues. Like argentamin, it is regarded as possessed of considerable antiseptic value.

When administered hypodermically the symptoms of metallic poisoning appear more quickly than with the nitrate, which may be due to the peculiar combination of the metal.

Therapeutics.—It may be used where silver nitrate is indicated; but, up to present writing, definite clinical data are wanting to establish its comparative value. It has been used with success in gonorrhœa and tried in gonorrhœal ophthalmia. In the latter affection it did not seem to be more effective than silver nitrate. The price of the drug is

such, however, that it can hardly be had generally.

In gonorrhœa Jadassohn recommended that it be used in the form of a solution of 1 1/2 parts of argonin to 100 of water. Of this solution 2 1/2 drachms are injected five times a day, the fluid being retained in the urethra for five minutes after each injection.

Used with great success in 72 cases of males and 158 females. The urethritis in both sexes rapidly subsides during its use, and the patient is more speedily restored by this treatment than by any other drug extant, as the gonococci are destroyed between two and six days. Bender (Med. Press and Circular, Aug. 12, '96).

Argonin employed in ninety cases of gonorrhœa, eighty being acute. Used in 5-per-cent. solution by the patient as a hand injection, the fluid being held in the urethra five minutes after each injection. Conclusions:—

1. It is absolutely unirritating and can be used in solutions of from 1 to 10 per cent.

2. In the great majority of cases it lessens the discharge very rapidly.

3. Its use is generally followed in a short period by a disappearance of the gonococci.

4. This disappearance of the gonococcus is not in all cases permanent; in other words, there is in quite a large proportion of cases a distinct tendency to relapse, with reappearance of gonococci.

5. It possesses distinct value as a hand injection in the stationary period of the disease, but is of very little benefit in the mucous stage, or stage of decline.

6. It produced no results in the treatment of chronic anterior urethritis. Christian (Ther. Gaz., July 15, '97).

Personal use of argonin failed to show any advantage it has over other drugs. C. F. Marshall (Treatment, Jan. 27, '98).

In gonorrhœal ophthalmia occurring in the adult argonin not found as beneficial as the silver-nitrate treatment usually employed. Kalish (N. Y. Med. Jour., Apr. 9, '98).

Thirteen cases of purulent ophthalmia in infants treated with argonin. Three of these had been treated in this way from earliest time of inflammation, and had been cured in 7 days. In the other case the average duration had been 13 days. A carefully prepared 3-per-cent. solution of argonin had been used. A minim dropper having been inserted deep under the eyelid, enough of the solution should be instilled to thoroughly irrigate the eyelids twice and, later, once in the twenty-four hours. Between these applications the lids were kept constantly clean with boric-acid solution. Fifteen grains of argonin contain as much silver as a grain of the silver nitrate. No neutralizing agent was required after its use. Horace Bigelow (N. Y. Med. Jour., Apr. 9, '98).

ARISTOL. — Aristol (di-thymol-di-iodide, annidalin), one of the most valuable of the newer antiseptics, occurs in crystals of a light-reddish-brown color, without odor.

It is insoluble in water, slightly soluble in alcohol, and freely soluble in ether and fats. It contains 45.8 per cent. of iodine. It is incompatible with acids, ammonia, corrosive sublimate, metal oxides, alkalies, and carbonates. Heat and light have a deleterious effect upon it.

Dose and Physiological Action. — Aristol is almost exclusively used as an external medicament, but may be given internally in maximum daily doses of 6 grains in cachets.

It may be used externally in the powdered form, and in 10-per-cent. solutions in ether or oils, and in the form of an ointment (10 per cent.). The strength of these preparations may be varied from 5 to 20 per cent.

Wax and lanolin are the best vehicles for an aristol ointment. If glycerole of starch is used the aristol undergoes partial decomposition with the formation of free iodine. With vaselin there was no decomposition, but the ointment was not very homogeneous. With benzoinated

lard there was also a feeble liberation of iodine. With wax and with lanolin no iodine was set free, and the ointment was perfectly homogeneous. These substances are, therefore, best fitted to be used as vehicles for aristol ointment. Fageardie (Jour. de Méd., Dec. 20, '96).

Aristol adheres very readily to the skin, and, therefore, makes an excellent dusting-powder. It is non-irritant to the unbroken skin, but when applied to the mucous membrane it promotes secretion. It is not absorbed either through raw surfaces or mucous membranes, and is therefore free from toxic effect.

When dusted upon wounds or ulcerated surfaces when abundant secretion is present, it serves to dry up the secretions and maintain cleanliness of the dressings.

If the surfaces under treatment be rendered aseptic in the beginning aristol will preserve asepsis.

It was found impossible to destroy cultures of the various cocci and bacilli by the application of aristol alone. If, however, a 10-per-cent. ethereal solution was used and the ether allowed to evaporate, aristol seemed to encapsule the germs and thus hinder their growth. A. Neisser (Berliner klin. Woch., May 12, '90).

Report of twenty-two cases of superficial wounds in which aristol appeared to change septic into aseptic processes. Pollak (Ther. Monat., Dec., '90).

Its germicidal action is very limited, and its effects on bacteria are negative. Stern (Fortschritte der Med., No. 19, '91).

It not only diminishes suppuration, but favors rapid cicatrization.

As a cicatrizant and resolvent, aristol is as inoffensive as it is prompt in its action. Seuvre (Union Méd. du Nord-est, Feb., '91).

It may be used instead of iodoform, possessing the advantages over that agent of being non-odorless and non-toxic. When given internally it produces no untoward symptoms.

In doses of 37 ½ grains per kilo weight of guinea-pigs and dogs there was no toxic action discernible. Quinquaud and Fournioux (La Tribune Méd., July 2, '90).

It seems to be eliminated by the urine as an alkaline iodide and, probably, also, as thymol.

Therapeutics.—Aristol is, perhaps, the most popular of the newer drugs by reason of the rapid establishment of its therapeutic uses and the advantages it possesses over others of its class.

Being non-toxic and odorless, it enjoys the distinction of displacing, in very many conditions, the older drug,—iodoform.

Simple Ulcer. — Aristol is of great value when the ulcer has been carefully scraped and disinfected, by actively stimulating cicatrization.

Three rebellious cases in which aristol was both prompt and inoffensive. Seuvre (Union Méd. du Nord-est, Feb., '91).

Report of forty cases in which aristol is considered of great value in the cicatrization of simple ulcers, being more rapid in its action and more readily applied than iodoform. Schmitt (Revue Méd. de l'Est, May 1, '91).

Series of fifty cases, mostly of suppurating wounds and varicose ulcers, but including some cases of ulcerative adenitis, chilblains, and boils, in which aristol ointment, 4 per cent. to 10 per cent., was used, applied on sterile gauze. In the varicose ulcers the results were impeded by the inability of the patients to take necessary rest. In ulcerating chilblains the action of aristol was especially prompt. Eriberto Arevoli (Incurabili, '96).

Burns. — Striking results have been obtained in cases of burns of the second and third degrees after other remedies had completely failed. Aristol ointment may be used, and the ease with which the dressing is removed and the early cicatrization obtained are noticeable features of this remedy.

Aristol may also be used in the form of powder for the treatment of burns. The surface should be disinfected with a boric-acid lotion, and after opening the vesicles aristol is applied and the whole is covered with sterilized cotton-wool, gutta-percha paper, and a bandage. The application of aristol powder directly to the wound at the beginning hinders the dressing from soaking up the secretion; when the latter has diminished, however, aristol may be applied either alone or in a 10-per-cent. ointment with olive-oil, vaselin, and lanolin.

Case of excessive suppuration of the legs, knees, and soles of the feet, occurring in an engineer as the result of scalding. An ointment of aristol changed the appearance in twenty-four hours, and from this time healing continued steadily and rapidly, an almost absolute cure being obtained in ten weeks. R. Y. McCoy (New Eng. Med. Monthly, Dec., '91).

Aristol is recommended as of value in burns, the pain being almost instantly relieved and healing being rapid. Haas (Deutsche med. Woch., p. 783, '94).

Wounds.—Aristol has been found of marked value in slight wounds.

Report of twenty-two cases of superficial wounds favorably treated with aristol. Pollak (Ther. Monat., Dec., '90).

Aristol film recommended for the prevention of secondary peritoneal adhesions. When, in abdominal surgery, the surgeon is obliged to separate extensive adhesions, there is always a dread that secondary adhesions will form shortly, and that the patient will continue to suffer from that source of trouble. The methods of smearing the surfaces of torn adhesions with oil, or filling the abdominal cavity with saline solution, are quite uncertain in the way of good results. When aristol has been dusted upon a wound it shortly forms a film with coagulated lymph, and forms a mechanical obstacle to the formation of secondary peritoneal adhesions. After separating all abnormally adherent peritoneal surfaces, and waiting until oozing has almost ceased, aristol is sprinkled over the fresh surfaces. After waiting for this to be held by lymph, this process is repeated, and, having formed a film of aristol and lymph over the region of adhesions, the abdomen is closed. Robert T. Morris (Amer. Gyn. Jour., Oct., '91).

Number of cases of lacerated and contused wounds about the head which healed favorably and with great rapidity. Arevoli (Incurabili, '96).

Skin Diseases. — Aristol has shown itself efficient in several forms of skin disease. In lupus it produces no effect until the ulcerative stage is reached, because of the fact that it has no action upon the unbroken skin and cannot, therefore, penetrate to the seat of disease.

In cases of lupus aristol was found to have an effect only when the nodules had been previously curetted. Neisser (Berliner med. Woch., May 12, '91).

Combined with curetting aristol healed a severe case in five weeks and it remained so ten years afterward. It is thought that the drug has a specific action upon the tubercle bacillus. Gevaert (La Flandre Méd., Feb. 21, '95).

In eczema it has not been extensively tried, but the results obtained would tend to indicate that aristol is of value.

Aristol used as an ointment (10 per cent. to 20 per cent.) in the treatment of eight cases with satisfactory results. Weissblum (Centralb. f. die gesammte Therap., May, '91).

In psoriasis it does not act as rapidly as chrysophanic or pyrogallic acid, but, being always harmless, it may be used with greater freedom and may thus prove more efficient.

Although it produced good results in twelve cases, conclusion that aristol is inferior to chrysarobin. Stern (Fortschritte der Medicin, No. 19, '91).

In severe cases it was found to be of little or no value. In one case it produced symptoms of irritation on the fourth day. Weissblum (Centralb. f. die gesammte Therap., May, '91).

HYPERIDROSIS AND BROMIDROSIS. — Used as a dusting-powder in these conditions satisfactory results often follow.

Aristol is regarded cleanly and efficacious in hyperidrosis. In some cases it was combined with iodol in equal parts. Daniel Lewis (Gaillard's Med. Jour., Aug., '91).

VENEREAL DISORDERS. — In many of the venereal diseases marked by ulceration aristol is of undisputed value. The majority of observers agree that the virus should be removed from the diseased areas with the curette before application of the drug.

It is useful in chancroids, syphilitic ulceration, and chancre.

Moist condylomata on the genitals of six syphilitic women almost dried up in three days by the use of aristol dusted on their surface. Other syphilitic growths in various parts of the body also did well by this treatment. Seifert (Wiener med. Woch., No. 13, '90).

Aristol acted best in ulcers previously freed from the venereal virus by some caustic, and in adenitis. In balanitis, balanoposthitis, and in initial gummata the drug produced slight effect, although better results were obtained in ulcerating gummata. Segré (Bollettino della Poliambulanza di Milano, Sept., Oct., '90).

Aristol tried in the treatment of syphilitic ulcers of various stages. Found of especial value in gangrenous ulcers and in ulcerating gumma of the penis and of the tibiæ. In the typical ulcers of syphilis it did very little good, being inferior to iodol. Salsotto (Gazzetta Medica di Torino, Oct. 5, '90).

Extensive trial in a large variety of venereal disorders, employing the medicament either as powder, in ointment, or in collodion. It acted promptly after destruction of the virulence in the infected focus. Aristol found superior to iodoform. Breda (Revista Veneta di Scienze Mediche, Nov., '90).

Aristol, locally applied, has acted better than other remedies. Rosenheim (Memphis Med. Monthly, Apr., '91).

In the true Hunterian chancre aristol acts injuriously. W. C. Wile (New Eng. Med. Monthly, July, '91).

In soft sores and gonorrhœa aristol found unreliable. Likewise useless in lupus. It did good as an aid after the healing was started by means of scraping; the same favorable results were noticed in other ulcerative processes. Stern (Fortschritte der Medicin, No. 19, '91).

DISEASES OF THE EYE. — Aristol has been found of value in indolent corneal ulcerations with suppurating base. The powder is thickly applied with a brush and the eye kept closed for a little time. In two days the base of the ulcer is said to become clean. It is also of value in blepharitis.

Valuable in inflammatory diseases of the eye, especially when it is required to suppress a focus of suppuration or repair a loss of substance, as in ulcerous or suppurative keratitis. Antiseptic and harmless. Bourgeois (Union Méd. du Nord-est, Feb., '91).

Its effects most markedly comprise follicular inflammations of the conjunctiva, phlyctenular disease of the cornea and conjunctiva, marginal blepharitis, ulcers, and after enucleation of the eyeball as a desiccant. In papillary trachoma the drug seems only to aggravate the symptoms. Wallace (Univ. Med. Mag., May, '91).

Two cases of keratitis dendritica, both of which were unassociated with herpetic trouble, and were apparently much benefited by insufflations of aristol. Morton (Annals of Oph. and Otol., Apr., '93).

In a 5-per-cent. ointment it is useful in ulcerative blepharitis, being preferable to the ointment of yellow precipitate on account of its causing less irritation. This ointment has given good results in obstinate recurring hordeola when rubbed into the edges of the lids at night. Heuse (Ther. Monat., Feb., '95).

Useful, after failure of other measures, in clearing base of corneal ulcers; useful as 5-per-cent. salve in ulcerous blepharitis and obstinately recurring styes. Heuse (Ther. Monat., Feb., '95).

Diseases of the Ear.—In affections of the organ of hearing it has shown itself of value when suppurative processes were present.

Twenty cases of suppurative otitis in which aristol proved serviceable. The cavity was first thoroughly cleansed and insufflations practiced. Rohrer (Wiener med. Presse, No. 20, '90).

The drug acts very favorably in acute and subacute internal otitis, and in external-ear inflammations. Burkner (Occidental Med. Times, Oct., '91).

Aristol effected a complete cure in twenty-two out of thirty-three cases of chronic purulent otitis, by means of insufflations. Krebs (La Semaine Méd., Aug. 22, '94).

Recommended in suppurating bony cavities and in otorrhœa with large perforation of tympanitic membrane. In cases of otorrhœa with small perforations it is dangerous from the liability to block up the perforation and cause accumulation of pus in the middle ear. Gevaert (La Flandre Méd., Feb. 21, '95).

Affections of the Nose and Throat.—Powdered aristol can be blown through the finest tubes to the remotest parts, and it firmly adheres to the mucous membranes. Sneezing or other unpleasant symptoms are not produced by its use. It increases secretion, and is therefore not to be recommended in the treatment of acute rhinitis or in other disorders in which there is much secretion. In all forms of chronic rhinitis in which the secretions are diminished or absent, the treatment by aristol is more or less successful.

Aristol tried in 11 cases of acute rhinitis, but found valueless. In 9 cases of rhinitis sicca, even when complicated by pharyngitis sicca, the results were good. In 3 cases of rhinitis atrophicans simplex, 6 of rhinitis atrophica fœtida, 2 cases of specific ozæna, with perforation of the septum cartilaginum, and 7 cases of laryngitis, the results were also favorable. Hughes (Deutsche med. Woch., May 1, '90).

Aristol is a more or less useful remedy in the treatment of nose and throat diseases, especially in cases of ozæna. In ozæna, a solution, in liquid petroleum, in the proportion of 40 grains to the ounce, may be employed. W. C. Phillips (N. Y. Med. Jour., May 23, '91).

In atrophic rhinitis, a valuable deodorizer and germicide, possessing, furthermore, the property of being somewhat stimulating and tending to increase the active watery elements of the abnormally inspissated secretions. Insufflated with a powder-blower, after thoroughly cleansing. H. C. Braislin (Brooklyn Med. Jour., June, '91).

Gynæcology.—Aristol has been found serviceable in endometritis, erosions, hyperplasia cervicis, parametritis, and eczema vulvæ. No unpleasant symptoms were produced, though large quantities were used. Iodine could not be found in either the urine or the saliva.

In chronic endometritis aristol acts as a valuable alterative, dissolved in a 10-per-cent. solution of albolene. W. B. Chase (Brooklyn Med. Jour., Jan., '94).

In endometritis, after thorough cauterization of the diseased membrane or curetting, the value of aristol in powder by insufflation is especially to be recommended. No deleterious effects from absorption need be feared and perfect asepsis is assured. Its value in ulcerations of the os and lacerations of the vaginal wall is self-evident. G. C. M. Meier (Times and Register, Apr. 11, '96).

In disorders of children it has been recommended by Moncorvo, who used it externally in more than one hundred infantile cases, the drug being carefully rubbed up in vaselin in variable proportions, and who gave it internally in cachets to tuberculous children, in maximum daily doses of 6 grains. In all these cases it proved a perfect substitute for iodoform, over which it has the advantage, at least for internal use, of being tasteless.

PHTHISIS.—In this disease aristol has been found more or less valuable when administered hypodermically. It reduced the night-sweats and cough, and the general health was much improved by its use, but it does not seem to merit much confidence.

Subcutaneous injections of aristol in six cases of phthisis, using a solution of 1 per cent. in mild almond-oil, in doses of 15 minims. The injections were not toxic, but very painful, the pain sometimes continuing throughout the entire day. They did not favorably influence the tuberculous process. It is true that in three out of the six cases the sweats were notably diminished, the cough less severe, and the expectoration more watery; but the results were, after all, not encouraging. No great reaction observed. Ochs (Ther. Monat., Jan., '93).

Aristol was employed in progressively-increasing doses up to 24 grains daily, and in increasing concentration up to 15 per cent., in the treatment of various forms of tuberculosis, with satisfactory results in cases not too far advanced. Bernardinone (Riforma Medica, No. 260, '94).

ARSENIC. — Arsenic (As), a native metal, appears as a lustrous, crystalline, brittle mass, of a steel-gray color, without odor or taste. It volatilizes above 100° C. Commercial white arsenic is prepared from the native ore by a process of roasting and sublimation.

White arsenic (arsenic, acidum arsenosum, arsenous oxide or anhydride, arsenic trioxide, As_2O_3), when pure, is a white, amorphous powder, odorless and tasteless. It is soluble in 30 parts of cold and 15 parts of boiling water; also in hydrochloric acid and glycerin. When thrown upon a heated surface a garlicky odor is emitted and the fumes resulting from volatilization are very poisonous.

Preparations and Dose.—Arsenic, $^1/_{60}$ to $^1/_{12}$ grain.

Liquor acidi arsenosi (1 per cent.), 1 to 10 minims.

Liquor potassii arsenitis (1 per cent.—Fowler's solution), 1 to 10 minims.

Liquor sodii arsenitis (1 per cent.—Pearson's solution), 1 to 10 minims.

Liquor arsenii et hydrargyri iodidi (Donovan's solution), 1 to 10 minims.

Arsenii iodidi, $^1/_{24}$ to $^1/_8$ grain.

Arsenii sulphidum, $^1/_{20}$ to $^1/_8$ grain.

Sodii arsenias, $^1/_{24}$ to $^1/_{12}$ grain.

Cupric arsenite, $^1/_{200}$ to $^1/_2$ grain.

SUBCUTANEOUS USES.—Liquor potassii arsenitis, 1 to 4 minims.

Liquor sodii arsenitis, 1 to 4 minims.

Arsenic, in the form of 1 part of anhydrous sodium arseniate to 100 parts of water, the dose being about twice that of Fowler's solution, recommended for hypodermic use. H. N. Moyer (Ther. Gaz., Jan., '91).

Scheele's green, or Paris green, is an impure arsenite of copper.

Clemens's solution—a solution of the bromide of arsenic—is prepared by boiling 57 $^1/_2$ grains each of arsenous acid and carbonate of potash in 8 fluidounces of distilled water and allowing the solution to cool, to which is then added sufficient distilled water to make 11 $^1/_2$ fluidounces. To this are added 115 grains of pure bromine. The resulting solution is kept for four weeks, being frequently shaken during the first week, or until it remains clear. Dose, 1 to 5 minims, freely diluted, after meals.

Cacodylic acid (dimethyl-arsenic kakodylic acid), a supposedly non-toxic and easily absorbed preparation of arsenic, is obtained from cacodyl and mercurous oxide in the presence of water ($AsO-[CH_3]_2OH$). It occurs in large permanent prisms, slightly sour and odorless; it is soluble in water and alcohol and melts at 200° C.

Soda cacodylate, a substitute for arsenic, is especially valuable in cases

where large doses of arsenic must be given. It is absolutely safe even in massive doses, being non-toxic in comparison with other arsenical compounds. It may be given hypodermically in doses of from 1 to 1 1/2 grains daily, and, by the mouth and rectum, 6 grains daily. C. W. Heitzman (Med. News, Aug. 17, 1901).

When administering arsenic the possibility of intolerance on the part of the patient should be thought of and the first doses should be small.

Results of experiences with rectal injections of arsenic. It is administered in solution containing 1/20 grain in 1 1/4 drachms. Three injections may be given daily. This treatment may be continued for months without having to be interrupted in consequence of gastric intolerance. Should any rectal irritation be caused the addition of a few drops of laudanum will obviate it. This treatment highly recommended in tuberculosis, especially in the early stage; in diabetes mellitus, and in exophthalmic goitre. Renaut (Les Nouveaux Remèdes, Apr. 24, '98).

Physiological Action. — If moistened and applied to the skin arsenic acts as an irritant, its power as such, however, depending upon the concentration of the preparation. The action upon the mucous membranes is identical.

Arsenic is readily absorbed, and must therefore be used with care.

Subcutaneous injection may be followed by pain, swelling, and even abscess and gangrene.

When administered internally and in small doses, arsenic stimulates the mucous membrane, thereby sharpening the appetite, but no other perceptible effects are produced. It raises the tone of the nervous and circulatory systems and increases the power of endurance.

By combining with the corpuscular elements of the blood these bodies are enriched; consequently the general nutritive forces are improved and the character of the tissues altered.

Symptoms observed during an epidemic of arsenical poisoning in Manchester. Sensory disorders seem to have been out of all proportion to the amount of beer or stout consumed. The most obtrusive phenomena were: 1. Numbness and tingling, which came on rapidly, in both hands and feet. In some a painful sense of a burning character in the soles of the feet, making walking painful, was all that was noted. 2. Pain, often most acute on pressing the soles of the feet, especially at the heel and ball of the great and little toes. In nearly all cases the pain on moving the joints was excessive, and especially so on pressing the muscles; this latter symptom was also noted in a number of cases in the forearm muscles. 3. Several of the patients showed a flushed appearance of the sole, especially at the great toe and heel, rarely spreading on to the dorsum of the foot, and associated with pain, making the picture of erythromelalgia; but the swelling, which when associated with pain and redness is described as typical of erythromelalgia, was seen in but one case. 4. Objective impairment of sensation was absent. 5. The knee-jerks were often present and at times unusually brisk. W. B. Warrington (Brit. Med. Jour., Jan. 5, 1901).

Armand Gautier found that small quantities of arsenic were present in the thyroid gland and other cellular elements. The writer, after a series of experiments on animals, confirms this fact, and concludes that arsenic is a normal element of the living cell, and is to be found in all animals and in all organs. Gabriel Bertrand (Le Bulletin Médical, Feb. 4, 1903).

In small, repeated doses arsenic acts on the bone-marrow, causing increase in the number of leucoblastic cells, little or no change in the number of erythroblastic cells, marked hyperæmia, and atrophy of fat-cells. During this stage there is no increase in the red corpuscles or hæmoglobin of the blood. In repeated doses, large enough to cause cachexia and emaciation, the bone-mar-

row undergoes hyaline degeneration. This is accompanied by decrease of the red corpuscles and hæmoglobin of the blood. All these changes occur with other drugs and poisons, and are not peculiar to arsenic. Arsenic has no direct effect in increasing the production of red blood-corpuscles by the bone-marrow. The "hæmatinic" action of arsenic in pernicious anæmia, malaria, lymphadenoma, leukæmia, and some other diseases probably results from a specific action on the parasites which cause these diseases, and not from any direct action on blood-formation. Stockman and Charteris (Jour. of Path. and Bact., May, 1903).

When taken for a long time the system becomes habituated to its effects; so that much larger doses may be tolerated.

The Styrian arsenic eaters take as much as 8 or 10 grains at once, but take no fluid immediately thereafter, so that absorption progresses slowly and elimination by the kidneys rapidly. This tolerance for the drug is undoubtedly due, to some extent, to environment and heredity, for imitators of the Styrians sooner or later suffer from its toxic effects.

Arsenic, used for a considerable period, produces a tingling and numbness of the tips of the fingers. (Hutchinson.)

Nutrition.—Arsenic, in doses of $^1/_5$ to $^1/_4$ grain, increases the elimination of urea and phosphoric acid and diminishes the elimination of chloride of sodium. In large doses—that is, more than $^1/_4$ grain—it diminishes the excretion of urea and increases the excretion of phosphoric acid and chloride of sodium. In small doses, the elimination of uric acid being augmented, nutrition is increased because the chloride of sodium, the stimulant *par excellence* of nutrition and the preservative of the red corpuscles, is retained in the organism in larger quantities than normal, thus stimulating nutrition, in spite of the loss of phosphoric acid. The contrary is the case when large doses are given, the unfavorable action being attributable, first, to the destructive effect of the drug on the red corpuscles, then to its action on the chloride of sodium, and finally to its action on the phosphoric acid. (Viratelle.)

Large doses are pronouncedly irritant, even causative of gastro-enteritis. The symptoms of such doses are usually slight burning or colicky pains in the epigastrium, nausea, diarrhœa, and, if the dose be sufficiently large, vomiting, purging, and generalized abdominal pain.

Close observation of the patient will disclose a puffiness about the eyes, particularly in the early mornings. This may increase into a decided œdema, and later may lose its local character and become general. The urine may or may not contain albumin and casts.

This puffiness about the eyes should, in the majority of cases, be regarded as the physiological limit of administration.

Nervous System.—Therapeutic doses stimulate, while large or toxic doses depress or even paralyze, the nervous mechanism. The sensory apparatus is usually the first affected, the reflex and motor following in order. The reverse may occur. Authorities agree that arsenic acts directly upon the nerve-centres through changes in the cell-elements.

A study of the literature clearly demonstrates that arsenical neuritis is most frequently due to acute intoxication with arsenic. Series of 253 cases, of which 136 were due to acute poisoning. The condition most frequently involves the lower extremities, and the peripheral parts—viz., the feet, the hands, and the lower part of the legs—are the favorite seats. W. Janowski (Zeits. f. klin. Med., Bd. xlvi, Nos. 1 to 4, 1902).

That the long-continued use of arsenic affects the peripheral nerves is certainly proved by the presence of a wide-spread multiple neuritis in many cases of chronic arsenical poisoning.

Tingling of the fingers, formications, headache, giddiness, and muscular tremors result from too large a dose of arsenic, while even convulsions may precede the paralysis of a lethal dose. The tendency to give arsenic in large doses, on account of its great value in certain diseases, is leading to the publication of several cases where paralysis has ensued.

Case of girl suffering from chorea who took arsenic in 15-minim doses, given three times a day for 31 days, except on 6 of those days. The chorea was speedily cured, and drug stopped; but 13 days after its cessation she began to suffer from symptoms which ushered in peripheral neuritis and almost complete paralysis of all extensor muscles below the knees, with well-marked reaction of degeneration, and some weakness of the extensor muscles of the forearms. She had arsenical pigmentation of the neck and the groins; but under treatment by rest, massage, and electricity she rapidly recovered. Colman (Brit. Med. Jour., Jan. 22, '98).

Arsenic interferes with the normal metabolism, but the exact nature of the chemical changes which occur is not understood. While beneficial in very minute doses, in sufficiently large quantities it may produce inflammation in any part of the body, either applied directly or through the circulation. The stomach may be irritated by direct action, or after the arsenic is absorbed the stomach may become the seat of inflammation from the arsenic in the circulation. The arsenic in the circulation reaches all tissues. Almost all of the symptoms are produced by the action of the irritant in this manner. There can be but little or no doubt that the cause of the recent Manchester epidemic was due to arsenic, because there was an absence of any other sufficient cause; sufficient arsenic was discovered to produce the symptoms of poisoning; and that the symptoms were identical with those produced by chronic arsenic taken in other ways. T. Lauder Brunton (Lancet, May 4, 1901).

There is no doubt as to the possibility for evil of small quantities of arsenic taken daily over a period of time. At the same time, there is no doubt as to the great therapeutic value of arsenic in certain morbid conditions, and as to the justification of the continuance of the use of this drug in these conditions. Serious chronic arsenical poisoning as a result of the administration of this drug is a rarity. The toleration of arsenic varies in different individuals and under different conditions. Arsenic is of signal value in chorea, malaria, asthma, and chronic heart affections. In the treatment of chloranæmia it is often combined with iron, but there is no evidence to show that arsenic acts as a hæmatinic tonic. Ralph Stockman (Brit. Med. Jour., Oct. 18, 1902).

Arsenical paralysis giving the same symptoms in three members of the same family. Arsenic was contained in some flour which all the patients had eaten. All three were seized with symptoms of acute arsenic poisoning, and within a fortnight developed the same symptoms of arsenical paralysis. They were troubled with anæsthesia and paræsthesias in the extremities, inability to work and to walk. The gait was unsteady and they were unable to stand with the feet close together. Their walk was slow, rigid, and irregular. There was left facial paresis, and abolition of the tendon reflexes, but no affection of the sensory nerves and no paresis of the upper extremities, save that in one of the three patients there was slight paresis of the fingers and thumb. The peculiar feature of these cases was that the paralysis was identical in all three, possibly owing to hereditary peculiarities. Luigi Ferrannini (Riforma Medica, June 3, 1903).

Skin. — The long-continued use of arsenic is not infrequently followed by changes in the skin. The changes may

be in the form of eruptions, pigmentation, etc.

Case of brown discoloration of the skin, produced by long use of arsenic, in a boy, 10 years of age, suffering from persistent fever, followed by exophthalmos and thyroid pulsation. The patient took, in two months, 1 ounce of the liquor potassii arsenitis of the German Pharmacopœia. He was discharged improved, but in fifteen days returned, exhibiting a yellowish discoloration of the skin, face, and trunk, which gradually deepened into brown. Foerster (Berliner klin. Woch., Dec. 8, '90).

Case of a woman of 40 years, who had taken arsenic for more than a year, in whom the skin became deeply pigmented, the heels cracked and sore, and the palms and soles very dry. There were also numerous large black freckles on the face. Hutchinson (Archives of Surg., vol. v, p. 364, '94).

Valuable as arsenic is as a medicine in certain ailments, if judiciously used, it occasions, if taken even in small doses for a length of time, not merely a dinginess, but a positive pigmentation, of the skin generally. On the palms and soles it exerts its stimulant action on the sweat-glands, giving rise first to hyperidrosis of these regions, then to the formation of warty corns around the sudoriparous orifices, and, finally, to a diffuse hyperkeratosis, associated with burning sensations. W. Allan Jamieson (Edinburgh Med. Jour., Jan., '98).

Case of arsenical melanoderma simulating Addison's disease, including the other symptoms of the latter. The progressive weakness and intestinal troubles of Addison's disease are not, as a rule, present in arsenical melanoderma, and, moreover, in the latter case there are associated dryness of the throat and conjunctivitis. The pigmentation due to arsenic does not often affect the hands or feet, and the peculiar speckled appearance of the trunk is characteristic. It is noticeable that, whereas in most cases a protracted course of arsenic is necessary to produce pigmentation, in certain predisposed persons a few very large doses will produce the same effect. Enriquez et Lereboullet (Gaz. Hebdom. de Med. et de Chir., July 6, '99).

Unusual poisoning symptoms in four cases of chorea which were taking arsenic. Peripheral neuritis developed in three of these cases without the usual premonitory signs of gastric and intestinal irritability. The paralysis affected the lower extremities, and came on gradually for several weeks after the termination of the patient's stay in the hospital. All of the cases recovered after protracted convalescence. If $6\frac{1}{3}$ grains of arsenous acid be given during three weeks, such peripheral paralysis may develop owing to slow elimination. F. C. Railton (Med. Chronicle, No. 2, 1900).

In snails poisoned with arsenic there was a general dilatation of the lymph-vessels, increase in the quantity of pigment, and fatty degeneration of the protoplasm of the parenchymatous cells without any symptoms of inflammation. Plants were also poisoned, and it was found upon analysis that they absorbed very little of the poison. Stich (Münchener med. Wochenschrift, Mar. 12, 1901).

Secretions.—In therapeutic doses it facilitates respiration, improves the circulation, and increases the urinary, salivary, biliary, and cutaneous secretions. (Comby.)

Elimination.—Arsenic is very rapidly eliminated, and chiefly by the kidneys. The mucous membranes of the alimentary tract, the skin, tears, and saliva also assist in the process.

Administered hypodermically to the dog in such doses as to produce acute poisoning, arsenic is eliminated by the urine almost wholly unchanged; the elimination, beginning immediately after the injection, is greatest during the first few hours, and continues for three or four days at the most. Even in cases in which small doses are given daily no traces of arsenites are discoverable in

the urine; in cases in which rather large doses are given daily for ten or twelve days the elimination of arsenites goes on for a somewhat longer time than stated above. (Severi.)

Healthy urines of 20 persons in Berlin examined for arsenic with completely negative results. Putnam, in America, found traces of arsenic in 20 per cent. of all urines tested; this is to show that suppression of all sources of adulteration and contamination by arsenic is being satisfactorily accomplished in Prussia. R. Richter (Viertelj. ger. Med., Apr., '98).

Administered by the rectum, arsenic is thrown out by the mucous membrane of the stomach in from one-fourth to one-half hour before the beginning of the elimination by the kidneys. (Kandidoff.)

Poisoning. — Acute poisoning is evidenced in from one-half to three-fourths of an hour by intense burning pain in the œsophagus and stomach, rapidly becoming general over the entire abdomen; an acrid, metallic taste; violent vomiting and purging; excessive thirst; suppression of the urine; collapse; convulsions or coma, and death in from five to twenty hours.

In smaller toxic doses the symptoms are less pronounced and death may not occur for six days.

In some cases profound and rapid collapse without pain has occurred; in others rapidly developing coma, which may be mistaken for cholera. Absence of epidemic and history should eliminate the latter.

Arsenical poisoning in children attending a Christmas party. Symptoms finally traced to the burning of candles which were found to contain Scheele's green. (Med. Record, Mar. 30, '89.)

As illustrated by the Robinson family (in which, with criminal intent, eight persons were poisoned with arsenic in five years) it is impossible to tell from the symptoms that we are dealing with a case of arsenical poisoning. Certainty can only be reached by a chemical examination, or proof that the poison has been taken into the system. A. F. Holt (Boston Med. and Surg. Jour., Aug. 1, '89).

Differential diagnosis between arsenical poisoning and ptomaine poisoning. In both conditions the character of the main signs is the same. The chief points of difference are that, in arsenic poisoning, swallowing may be difficult on account of pain in the throat; in ptomaine poisoning on account of paralysis of the constrictors of the pharynx; in ptomaine poisoning the pupils are usually dilated, and the muscular prostration is extreme, amounting, in fact, to paralysis. Harrington (Boston Med. and Surg. Jour., Dec. 14, '99).

Many cases of poisoning have been reported as a result of external application of arsenic. Introduction into the vagina has also caused death.

Death of a woman, aged 53, suffering with cancer, probably from the application of an arsenical plaster to the breast. A positive case also recorded as occurring in 1883, where an arsenical plaster applied to a tumor caused death. C. A. Cameron (Brit. Med. Jour., July 26, '90).

Case of a servant-girl, 25 years old, who committed suicide by introducing white arsenic into her vagina. The quantity found in the vaginal canal amounted to nearly 6 grains; in the internal organs $^1/_2$ grain of arsenous acid was found. Deceased had not been pregnant. Haberda (Wiener klin. Woch., No. 9, Mar. 4, '97).

Although the system can easily tolerate gradually increased doses, chronic arsenical poisoning is not of infrequent occurrence from various causes.

Record of twenty-six cases of chronic arsenical poisoning from wall-paper. Especial attention called to the frequent occurrence of albuminuria. James Putnam (Boston Med. and Surg. Jour., Mar. 7, '89).

A case of poisoning from the use of an arsenical ointment given in the treat-

ment of skin disease. During four months the entire amount used was calculated to be equivalent to 20 grains of arsenious acid. R. Krehl (Archiv f. klin. Medicin, vol. iv, No. 44, '89).

Six cases in which jaundice was present in chronic arsenical poisoning. A. Freer (Brit. Med. Jour., Aug. 1, '89).

Case of a patient, aged 50, who had for about twenty years taken $^1/_2$ to $^2/_3$ grain of arseniate of sodium daily. On increasing the dose he suffered from all the symptoms of arsenical poisoning. Inclination to think that the symptoms were due to a peripheral neuritis. Mathieu (Le Prog. Méd., vol. i, p. 244, '94).

Arsenic enters largely into the composition of various articles of domestic economy and was at one time a constant constituent of colored wall-paper. It is often added to common candles to give them a wax-like appearance. It is used in the binding of books, and the dust which collects on the top of the book-cases in libraries often contains considerable quantities of arsenic. It is a frequent constituent of the outside wrapper in which cigarettes and tobaccos are sold, and it is also used in coloring carpets, advertisement cards, playing-cards, India-rubber balls, dolls and children's toys, artificial flowers, sweets, hat-linings, gloves, and a number of other substances. There is an impression that arsenic is a common ingredient of the "face powders"; although zinc, bismuth, and lead are often present, arsenic is uniformly absent. (Murrell.)

A preliminary report as to the presence of arsenic in cigarette-wrappers: Out of seventeen series of different kinds of cigarettes and tobacco, arsenic was present in the labels of six, or more than a third. The arsenic in these cases was present in such large quantities that no difficulty was experienced in demonstrating the fact. Suggestion that, as the inhalation of arsenous acid, even in minute quantities, for a considerable time produces cough, hæmoptysis, expectoration, and loss of flesh, which are readily mistaken for phthisis, the advantage of accurate knowledge concerning this subject is most apparent. Murrell and Hale (Brit. Med. Jour., July 11, '96).

Treatment of Poisoning. — For the *acute* form the most effective antidote is the hydrated oxide of iron and magnesia, prepared by precipitating the solution of tersulphate of iron by magnesia. Twenty grains of the antidote should be given for every grain of arsenic ingested.

A solution of dialyzed iron, the tincture of the chloride, Monsell's solution, or any of the sesquialteral preparations may be substituted in emergencies.

An emetic should be given, or the stomach emptied by the pump, and, if the bowels have not moved, a dose of castor-oil or Epsom salts should be administered.

Demulcent drinks should be freely given, together with stimulation, external dry heat, and friction. Other treatment must be governed by the symptoms as they arise. Opium for pain, and large draughts of water if there be a tendency to suppression of urine, are also indicated.

In chronic arsenical poisoning the patient should naturally be removed from contact with the offending agent and treated symptomatically. Potassium iodide is the most effective agent in such cases.

The pathological changes are those resulting from violent irritation. Hyperæmia, infiltration œdema, ecchymoses, and membranous exudation, which is of a pale-yellow color and adherent to the swelled mucosa, are all to be noted. In the case of poisoning through the introduction of arsenic into the vagina there was acute inflammation, with false membrane on the labia minora and incipient sloughing of the rectal mucosa over the

recto-vaginal septum. The labia majora were also very œdematous.

Therapeutics. — Arsenic is well borne by children; but in too large doses, too long continued, it causes anorexia, grave disturbances of digestion, vomiting, diarrhœa, cutaneous eruptions, pallor, and anæmia. Although rarely prescribed before the age of two or three years, recourse may be had to it even in a nursling who has asthma, pulmonary tuberculosis, leukæmia, or pseudoleukæmia, or chronic malarial affections, hereditary or acquired. In older children the indications for arsenic become more numerous, but, as is the case with adults, arsenic should not be given in cases with nephritis, albuminuria, gastro-intestinal dyspepsia (with diarrhœa, vomiting, etc.), or in the acute infectious diseases.

The drug accumulating in certain viscera, the administration should be suspended for eight to ten days after fifteen days' use. Arsenic being very irritating to mucous membranes, it should be given well diluted. (Comby.)

Blood Disorders.—After the preparations of iron, arsenic is the best remedy we have in the treatment of uncomplicated anæmia. In pernicious anæmia it is far superior to iron; in fact, the latter remedy sometimes proves hurtful. In leukæmia and pseudoleukæmia it is also very beneficial.

> Report of 21 cases of anæmia successfully treated with arsenic: Ten recovered without recurrence; 5 had one relapse; 4 two relapses; and 2 six relapses. Of these recurrent cases, 4 were well at the time of report and 7 died during the relapse, generally from some complication. In leukæmia and pseudoleukæmia the results were not so satisfactory. Arsenic is as much of a specific in pernicious anæmia as mercury is in syphilis. Warfvinge (Trans. Eleventh Inter. Med. Cong., '94).

> New organic arsenical compound which obviates the unpleasant effects of the cacodylates and yet secures equal benefit. Such a substance has been found in arrhenal, or disodic methyl arsenite. This drug can be given by the mouth or subcutaneously, it has no odor, and is almost tasteless. It does not provoke nausea, eructations, garlic odor of the breath, dyspepsia, or renal trouble (albuminuria), and is thus superior to the cacodylates. The author has extensively used it with successive paludism, tuberculosis, chorea, bronchial asthma, leukæmia, and adenopathies, as well as in skin affections, for which arsenic has hitherto been prescribed. The dose for an adult should not exceed 15 centigrammes (or, in rare instances, 20 centigrammes) per day. A dose of 2 to 5 centigrammes thrice daily gives the maximum action, especially in tuberculosis. Gautier has also given it with success in hepatic congestion and cirrhosis, and in cases of intestinal and pulmonary hæmorrhage, but in the latter cases the dose should be small. The method of administration should generally be to give the drug for five to seven days continuously; then it should be stopped for an equal interval, and resumed as before. Gautier (Comptes-rendus de l'Acad. de Méd., Feb. 25, 1902).

Chorea.—In this disease arsenic has earned a well-deserved reputation; but the drug must be rapidly pushed to the point of tolerance. Then the doses are gradually decreased, so that at the end of ten to fifteen days the child is saturated with arsenous acid and frequently cured thereby.

> Experience has confirmed the value of arsenic as a specific in chorea. It should be rapidly pushed, increasing the amount by 3 minims per dose, t. d., every five days, until a child of ten years is taking 35 minims, t. d., or until vomiting is produced. In chronic cases arsenic in large doses rarely fails to cure when the drug in small amounts has proved useless. It is also serviceable in the grave chorea of pregnant women. J. Sawyer (Birmingham Med. Review, Jan., '88).

When arsenic is badly borne by the stomach it may be administered hypodermically. For this purpose Fowler's solution should be regarded as ineligible because of its irritant properties.

> The local irritation following the hypodermic injection of Fowler's solution is due to a small quantity of free arsenous acid in this preparation. It may be avoided by using a pure, anhydrous solution of arsenate of sodium, which was found more beneficial than any other remedy in twenty-eight cases of chorea. H. N. Moyer (Jour. Amer. Med. Assoc., Oct. 7, '93).

> Large doses of arsenic have a beneficial influence in subduing the movements, and this is best seen after the movements have existed for some time,—weeks or months,—that is, when a cure seems almost hopeless. The drug should be given after food, and the little patient should lie down for half an hour afterward in order to avoid nausea and vomiting. Walker Overend (Lancet, July 31, '97).

Infantile Diarrhœa, Cholera Infantum, etc. — Arsenite of copper has proved of great value in the treatment of summer complaint of children, especially in infantile diarrhœas and in dysentery. After administering calomel in minute doses, a solution of 6 to 8 tablets of $^1/_{100}$ grain each, in half a glassful of water, is given in teaspoonful doses every fifteen minutes until six or seven doses are taken, when a teaspoonful is ordered after each operation of the bowels. (Owsley.)

> Arsenite of copper does most good in acute forms of diarrhœa, and especially at the beginning of the disease, no success being obtained in a case that has been in progress for twelve hours. S. B. Overlock (N. Y. Med. Jour., Oct. 24, '91).

> The copper salts are powerful germ-destroyers, but should not be given in *all* cases of diarrhœa, the best results being observed in acute cases. H. B. Rue (N. Y. Med. Jour., Oct. 24, '91).

Pulmonary Disorders. — *Asthma.* — Arsenic sometimes proves useful in asthma when administered by the mouth, but it is more effective when inhaled in conjunction with hyoscyamus and stramonium-leaves, in cigarettes.

Phthisis. — The favorable influence upon nutrition exerted by arsenic renders it useful in this disease. Fowler's solution, the most satisfactory preparation, may be given in 1-drop doses at first, the amount being gradually increased to 10 drops. It sometimes proves efficacious in arresting night-sweats.

Malaria.—In the malarial cachexia arsenic comes second in value to the preparations of cinchona. It is especially valuable when the cases have resisted quinine, or when the latter is not well borne; it is also valuable in obstinate fevers complicated with marked anæmia and large spleen. It may also be used as an adjuvant to the antiperiodic alkaloids. Large doses are required.

Arsenic lends itself admirably to the hypodermic method, and is indicated when the salts of quinine are not well tolerated, and arsenic, on being resorted to, is in time not well borne by the stomach.

Arsenic is a valuable prophylactic against malaria. (Downie.)

Neuralgia and Gastralgia. — In these disorders arsenic is sometimes of value, especially when combined with counter-irritation.

> Arsenic is one of the best agents for the cure of simple gastralgia. Recovery is steadily attained in ordinary cases with a pill of $^1/_{24}$ grain of arsenous acid and 2 grains of extract of gentian. Sawyer (Dietetic Gaz., Jan., '88).

> Favorable opinion of the curative efficacy of arsenic in the various painful neuroses included under the name "gastralgia" in doses of $^1/_{24}$ grain of arsenous acid made into a pill with 2 or 3 grains of some tonic vegetable extract, such as gentian, three times daily half-way between meals. Scarcely any other treat-

ment is needed in cases of moderate severity. It should be continued for some weeks. In severer cases, counter-irritation to the epigastrium added. A varied dietary suits gastralgic patients far better than a restricted one. Trousseau's maxim, that "we should know what a patient does eat before we advise him upon what he may feed," should be followed. James Sawyer (Lancet, July 4, '96).

Skin Diseases.—Acute affections of the skin—especially the acute stage of erythema, eczema, urticaria, and prurigo—are not favorably influenced by arsenic. On the other hand, it represents the most effective remedy at our disposal in the treatment of chronic skin disorders when employed with proper discrimination. Fowler's solution is generally considered as the most useful preparation. From 3 to 5 drops in a half-glassful of pure water after meals are usually well borne. The dose should be slowly increased until the limit of tolerance is reached.

Psoriasis promptly yields, especially if the treatment is begun by the administration of a saline diuretic, such as acetate or bitartrate of potassium (Rohé).

Intravenous injections in 28 cases of psoriasis, in 25 of which no other treatment was adopted. Ten were completely cured, 6 were much relieved, and 9 reported as under treatment, but greatly improved. The commencing dose of 1 milligramme of arsenous acid increased daily by 1 milligramme up to 15 milligrammes, the maximum dose, which is repeated daily till the eruption disappears. Herxheimer (La Semaine Méd., clxii, '97).

Eczema also yields to the influence of arsenic, but only when it is employed in the chronic, dry, papular, or pustular stages of the disease. In the moist form it usually proves hurtful.

Acne, when attended by any degree of active inflammation, is aggravated by arsenic; but in the small papular form and that occurring during the menstrual period it frequently proves valuable, when administered in small doses.

Pemphigus is favorably influenced by arsenic when the latter is given in large doses. Urticaria, lichen, and furunculosis are also greatly benefited.

Tumors.—Fowler's solution sometimes retards the progress of epithelioma. It has proved curative in sarcoma and melanoma.

Case of spindle-celled sarcoma at head of tibia cured by internal use of arsenic. Koenigsberg (Deutsche med. Woch., Sept. 23, '94).

Case of malignant melanoma cured by Fowler's solution in 5-drop doses, t. i. d. Lassar (Deutsche med. Zeitung, No. 64, '94).

In cancer the local application of Marsden's paste (2 drachms of arsenous acid and 1 drachm of mucilage of gum acacia) is sometimes effective. A layer of paste one inch in diameter being applied over the growth, a piece of dry lint is applied on the part, overlapping the paste half an inch all around. After ten minutes the overlapping linen is carefully cut away and the paste is allowed to dry. At the expiration of two or three days bread poultices are applied every two hours until the redness and swelling present subside. A true line of demarkation appears, the skin ulcerates, and the fissure formed gradually extends until the cancerous mass comes away.

Case of a woman, aged 28, undergoing treatment for cancer of the breast, after the removal of the epidermis by a fly-blister. Within an hour she began to experience the physiological effects of arsenic: objects seen double or treble and marked tinnitus aurium. Within six hours severe vomiting and diarrhœa, which continued for more than a week. After four weeks she began to lose power in the extremities and rapidly became almost completely paralyzed. There was

pain and paræsthesia in the extremities. She began to improve, although incoordination of extremities well marked. Eight months later the patient was able to feed and dress herself and walk, but she remained an invalid a long time. A. R. Parson (Dublin Jour. of Med. Science, Sept., '95).

The radical cure of epithelioma by arsenous acid. Arsenic in powder proving abortive, a solution of arsenous acid in equal parts of rectified spirit and water, of the strength of 1 part of the acid to 150 of the menstruum employed. The first step is to thoroughly cleanse the sore by vigorously rubbing or scraping the raw surface, a moderate quantity of blood being allowed to flow. The surface of the ulcer is then thoroughly moistened with the solution, shaken up before using and allowed to dry, preferably without dressing of any kind. A scab forms, over which the solution is applied daily. The margins of the scab tend to separate from the subjacent tissues; the treatment is continued until the scab is only retained in place by a few loose adhesions. These are divided, the scab removed, and a fresh application of the arsenical solution is made. If on the following day the resulting scab is thin, of a light-yellow color, and easily detachable, it indicates that the tissues no longer comprise any trace of cancerous growth. If, on the other hand, a dark-colored, firm, and closely adherent scab again forms, the whole treatment must be repeated. The thicker the resulting scab, the more energetic should be the treatment: that is to say, the stronger should be the solution, the strength of which may then be increased from 1 in 150 to 1 in 100 or even to 1 in 80. When the desired result has been attained, there remains a granulating wound, covered with a delicate, white pellicle, to be dealt with on general principles. Czerny and Truneck (Med. Press, May 26, '97).

Case of epithelioma, in which recurrence had taken place after surgical interference, treated with painting the growth with Czerny's solution of arsenic, every two days. Cure took place in short time. Borde (Ann. de Derm. et de Syph., No. 2, '98).

Case of epithelioma of face treated with arsenous acid, which was applied to the surface of the ulcer and left exposed to the air, after the method of Czerny. Growth was completely destroyed by third month, and a month subsequent to this period the ulcer had cicatrized. Czerny's method consists in using three solutions of arsenous acid in equal parts of water and ethylic alcohol. The first solution is of the strength of 1 to 150, and is applied directly to the ulcerated area. The second and third solutions are stronger and are applied to the scab. The ulcer is touched with a solution every day, and, if the pain of application is severe, hypodermic injections of morphine are given. When the scab drops off, the raw surface is treated as is an ordinary wound. Hermet (Lancet, Mar. 26, '98).

Warts sometimes yield rapidly under the internal use of arsenic in small doses.

The internal administration of the liquor arsenicalis in the treatment of warts recommended. Report of a number of cases in which great success followed its use, and without any external application whatever. Pullin (Bristol Medico-Chir. Jour., Dec., '87).

Internal use of arsenic recommended for the removal of warts on the hands. The commencing dose for children is $^1/_4$ drop three times a day, the quantity being gradually increased. Paul Müller (London Lancet, July 4, '91).

Vomiting of Pregnancy. — In this condition arsenic is sometimes of value.

The following formula recommended in the vomiting of pregnancy:—

℞ Acidi arseniosi,
Ext. ignatiæ, of each, $^1/_2$ grain.
Pulv. ipecac,
Ext. cascara sagradæ, of each, 15 grains.
Ol. gaultheriæ, 2 drops.

M. et ft. pil. No. 20.

Sig.: One pill after meals, the patient being advised to take dry diet, with liquids principally between meals. J. Aulde (N. Y. Med. Jour., '91).

ARTHRITIS. See Joints, Diseases of.

ASTHMA (from the Greek, $\alpha\sigma\theta\mu\alpha$; from, $\dot{\alpha}\omega$, I blow).

Definition. — A neurosis characterized by more or less severe paroxysmal dyspnœa, due to spasmodic narrowing of the bronchial lumen, alternating with spasm of the muscles of the thorax.

Symptoms.—In the typical form premonitory symptoms—such as uneasiness about the chest, pallor, or a feeling of exultation, due to unusual good health —occasionally warn the patient that an attack is impending.

> Prodromata of asthma: (1) the dyspnœic laugh; (2) repeated sneezing; (3) stridulous laryngitis. Moncorgé (La Loire Médicale, Dec. 15, '95).

Suddenly, in the early hours of the morning in the vast majority of cases, great constriction of the chest and more or less marked suffocation, referred to the sternal region, are experienced. The dyspnœa, in bad cases, almost reaches the stage of apnœa; the respiration is wheezing in the milder cases, but in the others it is scarcely audible. The suffering of such cases is intense; the patient assumes various positions calculated to assist respiration; there is prominence of the eyeballs, distension of the superficial vessels of the neck, blueness of the lips; the skin is clammy and covered with sweat, etc.

The number of respirations per minute is usually reduced and the expirations are very much prolonged. The chest remains expanded; the abdomen is inordinately protruded through the descent of the diaphragm, and its muscles are tense and hard. Percussion gives rise to a drum-like, somewhat high-pitched note over the areas of the chest in which the distension of the alveoli by the imprisoned air is most marked. The cardiac and hepatic dullness outline becomes narrow and occasionally suppressed by the overlying inflated lung.

Auscultation reveals sibilous rhonchi of varying pitch and intensity, following the rhythm of the respiration. They resemble the chirping of birds of different varieties and size, simultaneously heard. This is accompanied or followed by mucous râles.

The variations in the pitch of the notes heard are due to the variations in the diameter of lumina left in the bronchi. Mucous râles are present, absent, coarse, or fine according to the nature of the secretions present. Sometimes nothing but the sibilous rhonchi are heard.

The pulse is usually slow and weak and the temperature is normal in the majority of cases, rarely reaching 100° F. Frequently it descends to 97 $^1/_2$° F.

After a period varying from half an hour to several hours the symptoms abate and end by a more or less profuse expectoration of viscid, stringy mucus, varying in opacity according to the severity of the attack.

In a small proportion of cases the fever, cough, and purulent nature of the sputum tend to show that catarrhal bronchitis is present as a complication. It is in these cases that emphysema is most likely to occur later on.

The expectorated substance is found to contain minute angular, octahedral crystals, visible with medium-power lenses, and recognized as the Charcot-Leyden crystals. They are soluble in warm water, the alkalies, and the mineral acids.

> [These properties, as shown by Salkowski, are those of mucin. The association is further supported by the fact that Loewy found the same crystals in the gelatinous nasal polypus, although asthma was not present. SAJOUS.]

The sputum also contains Cursch-

mann's spirals, which are frequently sufficiently large to be recognized with the naked eye. They consist of a fine, closely-packed layer of epithelial cells arranged in a spiral form around a longitudinal canal-like film. They are usually found in the thickest portions of the sputum.

[These are not pathognomonic of asthma, being also found in the diseases characterized by exudative inflammation of the bronchioles, as shown by Vierordt. SAJOUS.]

By pressing melted wax through a fine hole the spirals of Curschmann are imitated; they are produced when mucus is pressed through the contracted bronchioles; they must, therefore, be considered as a product, not as the cause, of the bronchial spasm. Lisberg (Hygieia, '90).

Spirals of Curschmann are not limited to any particular part of the bronchi, but are absent in the alveoli. The formation of spirals is caused by the whirling of the air during long paroxysms of dyspnœa or violent fits of coughing. Presence of fibrin noted in the sputum of six out of eight cases. Schmidt (Med. Chronicle, Nov., '92).

The spirals present in the sputum of asthmatic persons are not due to a twisting movement given to a mass of mucus in one of the bronchial tubes, but these structures are, in reality, casts of the smaller bronchial branches similar in nature to the casts in true plastic bronchitis. Fibrinous casts frequently show spiral terminations; these terminal spirals are identical with true Curschmann spirals. The spirals owe their peculiar structure largely to the greater number of cells present, and some of the spirals terminate in two equal branches of smaller diameter than the parent-stem. Laslett (Lancet, Nov. 7, 1903).

Large lymphoid bodies and granules, the eosinophile cells of Ehrlich, are also found.

[These also have been found in the contents of mucous polypi. SAJOUS.]

The urine is generally very copious, of low specific gravity, and light colored. It is usually more toxic after a night attack.

Complications. — The most important complication of asthma is emphysema. This is due to the repeated narrowing of the bronchi, which, assisted by the resulting local congestion, becomes more or less permanent and causes dilatation of the alveoli.

The pulmonary circulation is interfered with and dilatation of the heart and œdema may occur. The conformation of the patient's frame becomes changed, owing to modified action of the muscles of the back and chest. The sufferer stoops and his shoulders become raised.

Differential Diagnosis. — Attacks resembling those of the typical form may be induced by pressure on the trachea, aneurisms, goitre ("thymic asthma"), foreign bodies, vertebral disease, glandular enlargement, growths of the larynx and of the infraglottic space.

The tracheal traction test in the recognition of asthmatic lung. When the head is thrown forcibly backward the normal resonance obtained by percussion over the manubrium and contiguous lung-tissue is converted into a dull or flat sound. The findings are positive in health and in all cardio-pulmonary affections, but it is absent in cases of idiopathic asthma. The test is a valuable aid in the diagnosis of idiopathic asthma, and differentiates it from symptomatic asthma and other spasmodic pulmonary affections. The tracheal traction causes a contraction of the bronchial muscle by stimulation of the pneumogastric nerves. In asthma the tone of the bronchial muscle is so reduced that it no longer responds to vagus stimulation when the neck is forcibly extended, hence the tracheal traction test in idiopathic asthma is negative. A. Abrams (Med. News, June 25, 1904).

They may also be due to irregularity of the bronchial circulation through cardiac disorders, tuberculosis, bronchitis, or narrowing of the respiratory area by mediastinal tumors.

Infraglottic disorders, growths, and syphilis especially may give rise to a form of dyspnœa simulating that of asthma. Sajous (Jour. of Laryn., Rhin., and Otol., Sept., '95).

The great majority of urgent cases of acute stenosis seen occurred low down in the larynx, either in region of true or false vocal cords or below the glottis. Macintyre (Jour. of Laryn., Sept., '95).

Bronchitis.—In children asthma sometimes assumes the character of capillary bronchitis. In all forms of bronchitis there are absence of periodicity, greater amount of expectoration, marked increase in number of respirations, free chest-motion, and more or less fever.

Pneumonia.—In this disease the respirations are greatly increased in number, and there is panting, besides free chest-motion. There is also high fever.

Croup and Other Laryngeal Diseases.—In these disorders there is interference with the respiration: inspiratory instead of expiratory.

Emphysema. — In emphysema the dyspnœa is continuous, though liable to exacerbations.

The dyspnœa of emphysema is too often attributed to asthma. While bronchial asthma of nasal origin occurs when the patient is at rest, and especially at night, the dyspnœa of emphysema mostly appears on exertion. Schech (Münchener med. Woch., Aug. 18, '96).

Heart Disease. — Dyspnœa usually follows exercise or becomes greatly aggravated by it in cardiac disorders. In advanced cases the dyspnœa is continuous and the cardiac lesions are easily recognized.

Cardiac asthma occurs suddenly at night, on account of the greater tendency to venous stasis, with dyspnœa lasting at most a half-hour. They generally reappear night after night, rarely twice in one night. They occur in cases of mitral insufficiency with loss of compensation, and in cases of advanced arteriosclerosis with cardiac dilatation, myocarditis, and renal insufficiency. M. Merklen (Jour. des Praticiens, Apr. 20, 1901).

Spasm of the Diaphragm.—In this symptom there are sudden spasmodic expulsive efforts; frequently accompanied by hiccough.

Uræmia. — The dyspnœa occurring as a symptom of uræmia is more or less continuous and accompanied by presence of casts in the urine.

Etiology. — Heredity shows itself in about one-half of the cases when three generations are included in the computation.

The influence of heredity is very great; the absence of asthma in the family history greatly increases the chances of cure. Dauchez (Revue Mensuelle des Maladies de l'Enfance, July, '94).

[If collateral diseases dependent upon an arthritic diathesis, rheumatism, gout, migraine, etc., are included as predisposing factors, as taught by Trousseau, almost every case will be found to be hereditary. Sajous.]

Asthma presents itself before the age of ten years in one-fourth of the cases, but it may occur at any period. It is more frequent among males than among females. The wealthy are more prone to it than the poor, owing to dietetic errors and sedentary habits, the latter cause also explaining the disease's predilection for persons deprived of physical exercise, such as clergymen, lawyers, clerks, etc.

Atmospheric influences are active factors in the production of an attack. Excessive dryness, such as that of overheated or insufficiently ventilated rooms, or, on the contrary, excessive dampness

may bring on a paroxysm. Cases in which a rheumatic diathesis exists are especially sensitive to dampness.

A patient living on one side of the street may be exempt from asthma, while on the other he may be affected. This may be due to the fact that on one side he lives in a shady room, and on the other in a sunny one. This is a factor of no small moment, in not only the asthmatic, but in all subacute and chronic bronchial disorders. J. B. Walker (Report of Amer. Climat. Soc., Boston Med. and Surg. Jour., Nov. 17, '98).

Asthma, and the predisposition thereto, depend upon four causal factors. Tendency to (1) bronchial spasm (increased tone of the bronchial muscles), (2) vasomotor insufficiency (decreased tone of vascular musculature), (3) congestive hyperæmia of the respiratory mucous membrane, and (4) an abnormal specific secretion from the same. These four factors may be influenced by the peripheral nervous system, the constituents of the blood, or the cerebrum, especially the cortex; thus, asthma may be peripherigenic, hæmatogenic, or psychogenic and cerebral. Sihle (Wiener klin. Woch., Jan. 22, 1903).

Pathology. — Various theories have been propounded to explain the dyspnœa, but the prevailing one to-day is that it is due primarily to spasm of the smaller bronchi, as taught by Laennec, Biermer, and Williams, and, secondarily, by spasm of the muscles of the thorax and of the diaphragm, which are unable to cause expulsion of the air imprisoned in the alveoli on account of the restricted lumen of the bronchi.

That the spasm depends upon the contractility of the circular muscular fibres of the bronchi and that it is essentially spasmodic in character is the only view by which the phenomena of the disorder can be adequately explained. Wilson Fox (Times and Register, Apr. 2, '92).

The spasm of the bronchi, by impeding respiration, produces an excess of CO_2 in the blood, which causes abnormal stimulation of the vagi. This action and reaction are further influenced (1) by the reciprocal effects of an accumulation of CO_2 in the central nervous system and a retardation of the circulation; (2) by the rapid production of CO_2 in the organism, in consequence of the powerful efforts required for the movements of respiration. Einthoven (Nederlandsch Tyd. voor Genees., Oct. 7, '93).

Asthma, in accordance with the view of Germain Sée, must be considered a bulbar neurosis consisting in an excessive reflex irritability of the respiratory centre. This may be disturbed in its action by a peripheral irritation. Schmiegelow (Chicago Med. Recorder).

From examination with the aid of the fluoroscope of four cases of asthma during the paroxysm, it was possible to conclude that spasm of the diaphragm is not the only cause of asthma. H. Schlesinger (Wiener klin. Woch., Apr. 14, '98).

Hyperpyræmia, that is, accumulation of unoxidized carbonaceous material in the blood beyond the capacity of the physiological decarbonizing processes, is an essential factor in some cases of asthma; and in such the recurrent asthmatic paroxysms may be regarded as ultraphysiological, that is, pathological reinforcements of inadequate physiological decarbonization. But even so, hyperpyræmia is only one of many factors in asthma. For example, the asthmatic paroxysm depends upon the vasomotor response to hyperpyræmia; and this responsiveness of the vasomotor system may be vastly increased by numerous factors. When this is so, the vasomotor responsiveness (irritability) becomes a much more important factor in determining paroxysms, and consequently calls more urgently for therapeutic attack than the food factor. And there are many other factors to be considered. Hence it must not be inferred that asthma can always be successfully treated by diet of any kind. Nevertheless, the food factor is usually, if not always, present, and its due recognition will often make the difference between successful and unsuccessful therapeutics. For those who are inclined to make a trial of the treatment by restriction of the carbonaceous intake, the author

would suggest that commencement be made with asthmatics with a tendency to corpulency. Indeed, in such, success is much more easily and rapidly attained. Francis Hare (N. Y. Med. Jour. and Phila. Med. Jour., Sept. 23, 1905).

The diminished lumina of the tubes and the paresis of the muscles of the chest-walls may be primarily incited by four classes of factors:—

1. Reflex action, the starting-point of which may be located in the naso-laryngeal tract, the ear, the mouth, the stomach, or the genital organs, etc.

Nasal disease sometimes, though not necessarily, constitutes the inciting factor; asthma associated with nasal polypi observed in 22 per cent. of personal cases, and with chronic rhinitis in 8 per cent. Schmiegelow (Chicago Med. Recorder).

Eighty cases showing that of the three elements which enter into the causation of asthma,—viz., a neurotic habit, nasal disease, and atmospheric conditions,—the nasal disorder outweighs all. Bosworth (N. Y. Med. Jour., Dec. 29, '88).

Distressing cases due to retroversion of the uterus and pressure on the sacral nerves; irritation reflected to the pneumogastric. Further attacks prevented by the reposition of the womb. Carpenter (Times and Register, Jan. 4, '90).

Sexual asthma; eleven males and five females. In almost all the male cases there was a history of spermatorrhœa, together with self-abuse and impotence; attacks followed immediately on coitus or other sexual excitement. Peyer (Berliner Klinik, Mar., '90).

Out of four hundred cases the superior turbinated, and sometimes also the inferior turbinated, found so swollen as to come near the septum. Torstenssohn (Edinburgh Med. Jour., Jan., '92).

Case in which the sputum possessed characteristic features of asthma: Leyden's crystals, spirals, and sago-like pellets, etc. The attacks of asthma and this characteristic sputum were present only during the menstrual period. The patient, aged 32 years, was in every other respect healthy. Katz (Deutsche med. Woch., Dec. 10, '96).

Two cases in which the breathing was characterized by unusual slowness and depth, and amounting in one case to orthopnœa. Cessation of the asthmatic trouble in one case after restoration of a retroflexed uterus. Strubing (Zeitschrift f. klin. Med., B. 30, H. 1, 2, '97).

Even in the finer bronchioles of the lower animals there exists a powerful layer of circular fibres and a weak layer of longitudinal fibres. The same condition exists in the bronchioles of human beings, particularly in portions of the lung adjacent to the inflammatory foci. These two sets of muscle-fibres thus have an antagonistic action in cases of inflammatory infiltration. The weaker longitudinal fibres are more affected than the horizontal fibres, and are unable to oppose their contraction, which reduces the diameter of the bronchioles. Aufrecht (Deut. Archiv f. klin. Med., B. 67, H. 5, 6, 1900).

2. Irritation of the bronchial mucous membrane, in catarrhal processes, by dust of various kinds, metallic (grinders' asthma) or pollen, and the emanations of various plants, fruits, animals, etc., in beings hypersensitive to their action, or of irritating chemicals: sulphur, phosphorus, etc. (See HAY FEVER, INDEX.)

3. Irritability of the sympathetic system through the sudden arrest of peripheral disorders: eczema, urticaria, psoriasis.

Frequent occurrence of asthma among persons who, in their youth, suffered from stubborn cutaneous eruptions. Von Noorden (Zeit. f. klin. Med., B. 22, '92).

Case of urticarial asthma due to mussel poisoning, indicating the relationship between urticarial eruption of the skin and that of the mucous membrane, strongly advocated by Andrew Clark as the main cause of asthma. G. Martyn (Brit. Med. Jour., June 8, '95).

Case of a boy whose mother was an asthmatic and who suffered from parox-

ysms of asthma and eczema which were sometimes concurrent, sometimes definitely alternating, sometimes overlapping each other, the patient at no time being quite free from either. Latterly he has had intermissions of from four to five weeks in the asthmatic fits, but the chronic eczema has been more or less constant. Personal belief that asthma may be due to some sudden vascular engorgement or erythematous blush of the bronchial mucosa. As against the eczematous origin of these attacks, attention called to the non-evanescent nature of eczematous eruptions. Taylor (N. Y. Med. Jour., Oct. 21, '99).

4. Irritability of pneumogastric nerve following whooping-cough, measles, or infantile bronchial disorders, or through pressure upon it of enlarged bronchial glands.

In infants the bronchial glands are often the site of congestive and inflammatory conditions following bronchitis, measles, and pertussis, the causes of the attacks being those which produce congestion of the glands, crying, variation of temperature, chilling, etc. Joal (Arch. Gén. de Méd., Apr., '91).

There is only one way of artificially producing asthma, and that is to divide the left vagus in the neck and gently stimulate the proximal end with electricity. By this method asthma is produced in the right lung and spasmodic contractions in the right half of the diaphragm. We must look, therefore, for the cause of asthma in some tissue or tissues supplied by the vagi and the sympathetic nerves, or in a lesion of the nerves themselves. E. Kingscote (Brit. Med. Jour., Oct. 13, 1900).

The four above-mentioned factors are able to give rise to the pulmonary and muscular phenomena, owing to the untoward accumulation in the system at large of (1) products of metabolism which fail to be eliminated through hæmatopoietic or renal insufficiency, uric acid, acetone, etc.; (2) extraneous toxics, such as lead, mercury, etc.

Case in which asthma replaced epileptic fits. The pent-up nerve-storm, instead of discharging itself in the customary channel in an epileptic seizure, expended its energy upon the bronchial muscular fibre, giving rise to the protracted asthmatic phenomena. After many hours it exhausted itself by way of an orthodox "fit," thus bringing the disturbance to a conclusion. Francis Taylor (Lancet, June 10, '92).

An excess of uric acid in the blood contracts the arterioles all over the body and produces high arterial tension. Asthma represents the effect on the thoracic circulation of this high arterial tension, while migraine and epilepsy represent its effect upon the circulation of the brain. A. Haig (International Clinics, vol. iv, '94).

Nervous asthma is usually due to intoxication. The attacks occur at night, because the urine is more toxic then than in the day-time. Huchard (Revue Gén. de Clin. et de Thér. Jour. des Prat., Feb. 22, '96).

Five cases which occurred in aged patients, all of them showing evidence of arteriosclerosis and weakness of the cardiovascular system, and a number of them had attacks resembling angina pectoris. The essential feature of the case was that they had severe attacks of asthma which came on almost solely at night, and that in all these instances the use of catheter disclosed a certain degree of retention of urine, and the evacuation of the bladder caused the entire disappearance of the dyspnœa with surprising rapidity. Autointoxication was probably the cause, due to greater difficulty in emptying the bladder when the patients are at rest in a horizontol position. Pawinski (Revue de Méd., Mar. 10, '99).

Asthma due to dyspepsia. The most typical cases occur in children usually of neurotic inheritance. To suppose that they are due to autointoxication is the most easy assumption, but the ptomaines and toxins hitherto isolated for the most part act differently upon the heart: slacken it instead of accelerating. Probably there is an increased bulbar receptiv-

ity in these cases, and reflexes are more easily exciting than usual. Acetonuria is not infrequently present. Strong evidence of the dyspeptic nature of the attacks is afforded by the cases in which the exhibition of purgatives or emetics gives prompt and immediate relief. Moreover, there are generally signs of dyspepsia; for example, furred tongue, foul breath, nausea, and vomiting. Treatment should be directed accordingly. Landi (Clinica Mod., An. 5, No. 24, '99).

Two fatal cases have proved the correct personal former belief that the anatomical findings in the lumen of the bronchi are not always the same. There exists, however, a bond of union between them all in the abundant epithelial desquamation. A. Fraenkel (Deut. med. Woch., Apr. 6, 1900).

Chronic dyspeptic asthma witnessed in 5 cases. The acute type occurs after meals and is characterized by dyspnœa, cyanosis, and irregularity of the pulse. In the chronic type there is continuous shortness of breath on slightest exertion. Both forms yield readily to treatment of the gastric disorder. No particular form of stomach trouble is responsible for the condition. F. H. Murdoch (N. Y. Med. Jour., Jan. 12, 1901).

Prognosis.—The prognosis of asthma depends upon the nature of its underlying cause. Cases of reflex asthma in which the primary disorder is easily reached and properly treated,—such as nasal hypertrophies, polyi, aural growths, etc.,—are frequently cured and remain so, provided the causative affection does not remain. The prognosis is also good in young subjects with well-formed chests and in whom direct heredity cannot be traced. In all others, however, the chances of recovery are very limited.

Death rarely ensues from spasmodic asthma, but its complications may prove fatal.

Treatment.—The treatment of asthma consists of (1) arrest of the paroxysm; (2) prevention of the paroxysms by measures calculated to annul the effects of exciting factors; and (3) removal of the pathological conditions forming the basis of the paroxysms.

1. Paroxysm. — Before instituting measures calculated to arrest an attack, the nature of the disorder giving rise to dyspnœa as a symptom must be carefully determined. Were a paroxysm found to be due, for instance, to a cardiac affection, the remedies most frequently prescribed — stramonium, belladonna, and the various anæsthetics — would prove dangerous. When the presence of true asthma is ascertained beyond a doubt, the object should be to relieve suffering, and narcotics, or the so-called "depressants," are indicated. Two important facts must be borne in mind by the practitioner, however, namely: the danger presented by all narcotics to give rise to habits of inebriety, and the necessity of giving sufficiently large doses to produce physiological effects if satisfactory results are to be attained.

The bimeconate of morphine, $^1/_4$ grain by the mouth, or, better still, 10 minims of Magendie's solution, given hypodermically (the dose varying, of course, with the age of the patient), are the most satisfactory agents when rapid effects are necessary, especially if combined with atropia (not more than $^1/_{120}$ grain being given in any case). Codeine may be used instead of the morphine if the latter produces nausea. These remedies present, as objections, however, the partial suppression of expectoration in some cases, and a certain amount of danger in cases of Bright's disease. Strychnine may be advantageously added to stimulate the vasomotor system and equalize the circulation.

Subcutaneous injection of a combination of strychnine sulphate, $^1/_{30}$ grain, with atropine sulphate, $^1/_{200}$ grain, re-

peated daily or as necessary. Mays (Philadelphia Polyclinic, Jan. 5, '95).

Chloral-hydrate comes next in order when prompt relief is required; 15 to 20 grains may be given to an adult. Marked cardiac disorder renders this drug dangerous; the heart should be carefully examined.

Chloroform proves rapidly effective in some cases. Fifteen drops in a half-tumblerful of water to which a teaspoonful of syrup of orange-peel has been added make up a palatable dose. Sulphuric ether, 30 to 40 drops, may be used in the same way, or be administered on a piece of sugar, but the sudden volatilization produced by the heat of the stomach causes eructations which are unpleasant to the patient. Hoffmann's anodyne (compound spirit of nitrous ether), 1 drachm in half a tumblerful of pure water, is frequently effective. The dose should be repeated every half-hour.

During a paroxysm the following is effective:—

℞ Tr. opium, 1 drachm.
Ether, 2 drachms.

M. Sig.: Fifty drops at intervals of one-half hour until the spasm is relieved. Editorial (Journal de Méd. de Paris, Apr. 14, '97).

For the relief of the asthmatic paroxysms a combination of

℞ Morphine sulphate, $^1/_8$ to $^1/_4$ grain.
Strychnine sulphate, $^1/_{60}$ to $^1/_{40}$ grain.
Hyoscine hydrobromate, $^1/_{200}$ grain.

should be given hypodermically at bedtime. In some cases its repetitions is unnecessary; in others after two or three injections complete relief from the attack has been observed. Considerable caution must be exercised as to its repetition. S. Solis-Cohen (Phila. Polyclinic, Oct. 9, '97).

Case of distressing asthma which failed to yield to all treatment until adrenal substance was used. Tablets containing 5 grains each were prescribed once, then twice, then three times daily, and finally the patient for a time took 90 grains daily. A striking improvement shortly became manifest. The constant dyspnœa first disappeared, then the paroxysmal nocturnal attacks became less frequent and less severe. Recovery was not rapid, but was continuous. S. Solis-Cohen (Jour. Amer. Med. Assoc., May 12, 1900).

General anæsthesia is sometimes employed to advantage, but is not to be recommended unless other means have failed. Chloroform inhalations are the most effective. Ether irritates the larynx and sometimes causes marked distress.

[When general anæsthesia is resorted to, the inhalations should not be vigorous at the start. Severe dyspnœa may otherwise be induced through the laryngeal irritation produced. A preliminary application of a 5-per-cent. solution of cocaine to the nasal cavities greatly increases the efficacy of the anæsthetic inhaled.

Anæsthetics are dangerous in cases of infraglottic thickening, symptoms of which greatly resemble chronic asthma. Hill reported a case in which death very nearly ensued through the use of ether. SAJOUS.]

Iodide of ethyl, 6 or 8 drops, inhaled from a piece of lint. Thorowgood (Med. Chronicle, Mar., '95).

Spray chloride of methyl rapidly over the back of patient. The attack ceases in a few moments; if not, light spraying of upper part of the chest. If the skin is delicate, cover the parts with fine gauze. Tsakiris (Gaz. des Hôp., Mar. 12, '95).

The application to the mucous membrane of the nasal cavities of a 5-per-cent. solution of cocaine is highly recommended by Dieulafoy.

Pure carbonic-acid gas, inhaled for from 5 to 10 minutes at a time, using frequently, proves successful. The benefit is probably due to the inhibitory effect of the gas on the larynx,—an abolition of the reflex sensibility; it appears to cut the paroxysms short when given during

the attacks. Weill (La France Méd. et Paris Méd., Mar. 8, '88).

The smoke obtained from antispasmodic remedies—nitre, stramonium, tobacco, hyoscyamus, and belladonna—is efficacious in cases in which emphysema is not marked.

Cigarettes may be made of paper soaked in a saturated solution of nitrate of potassium and belladonna. The sheets are allowed to dry, and are then rolled into the shape of cigarettes.

An effective cigarette may also be made of equal parts of lobelia, stramonium, and green tea-leaves, or of stramonium-leaves and ordinary tobacco. Tobacco sometimes proves useful alone where it has not been previously used.

The famous hyoscyamus and stramonium cigarettes of Espic are composed of the following agents:—

℞ Belladonna-leaves, 6 grains.
Hyoscyamus-leaves, 3 grains.
Stramonium-leaves, 3 grains.
Extract of opium, $^1/_4$ grain.
Cherry-laurel water, q. s.—M.

The most active principle in the above combination being pyridine, the cigarette may be replaced by inhalations of the drug, 10 to 15 drops being inhaled from a handkerchief. The following method of using pyridine, however, is the most effective:—

The patient being in a small room, a saucer containing pyridine is put some distance from him. He is allowed to inhale the fumes about half an hour. (Germain Sée, Chicot, Kelamin, Dieulafoy.)

Hyoscyamine, $^1/_{140}$ to $^1/_{120}$ grain, given hypodermically, is recommended by Musser.

Paraldehyde, 30 grains hourly until improvement is noted, is recommended by Mackie and others.

Paraldehyde administered in a number of cases of idiopathic asthma and other forms of spasmodic dyspnœa with satisfactory results. It not only relieves the spasm, but it induces tranquil refreshing sleep without any objectionable after-effects. Besides, no evil results follow a prolonged use of paraldehyde; it does not give rise to a habit, and on this account it is a much more desirable drug than morphine and chloral. Iodide of potassium and tincture of lobelia, as a rule, do much to relieve the bronchitis and to lessen the spasm, but their effect is immensely increased by securing sleep and the prevention of the nocturnal spasms by means of paraldehyde. The drug occasionally causes sickness, and for this reason it proved of no use in a severe case of long-standing bronchitis and emphysema. Its disagreeable pungent taste makes it objectionable to children and nervous patients, but it is well disguised in cinnamon-water and tincture of orange-peel. It acts, as a rule, so rapidly that the dose ought to be taken after the patient has gone to bed. In adults it is best to begin with a dose of 60 minims, and the same dose has equally good hypnotic effect when it has been taken for months. Alexander MacGregor (Lancet, Feb. 11, '99).

Passion-flower (passiflora incarnata) possesses hypnotic and antispasmodic powers, and in sufficient dosage it would probably act as a narcotic poison. Even in moderate doses it may in some cases provoke nausea and emesis. The combination of relaxant influences gives it peculiar value in allaying asthmatic paroxysms and in preventing their full development. It may be given in tincture or fluid extract. The dose is from 10 to 30 minims well diluted and given from every ten minutes to every half-hour until relief is experienced, emesis caused, or drowsiness induced. Half a fluidounce of the fluid extract has personally never been exceeded in the course of two hours. Patients have fallen asleep after 6 doses of 10 to 20 drops each, given every ten or fifteen minutes, or after a single dose of 1 fluidrachm. In two out of eight cases its use produced but slight mitigation

of distress, and was abandoned. In six cases rebellious to other methods it gave prompt relief. S. Solis-Cohen (Amer. Medicine, Sept. 14, 1901).

Antipyrine, 15 grains being given every three hours until the access is relieved, proves especially effective in anæmic cases; but such large doses are toxic in some cases. Again, it sometimes does harm in increasing the severity of subsequent attacks, particularly in a case associated with bronchitis.

Caffeine citrate—1 to 5 grains, dissolved in warm water every four hours — is especially effective in bronchial asthma and in bronchitis associated with spasm of the bronchial tubes.

We have in adrenalin a drug which is more efficient in the relief of asthmatic attacks than those ordinarily used in the treatment of those conditions. Even large doses of the drug freely used do not give rise to a glycosuria. Adrenalin chloride has a distinct place in the therapeusis of asthmatic seizures. Although relieving the paroxysms with greater promptness and certainty than most of the other drugs at our command, the hypodermic use of adrenalin chloride is in no sense curative of the disease as such, and equally useless are prophylactic injections. Kaplan (Med. News, May 13, 1905).

Glonoin, composed of 1 part of nitroglycerin to 99 parts of alcohol, given in doses of $^1/_{100}$ to $^1/_{50}$ grain, acts rapidly in some cases; but even in these its effects are frequently only temporary. From 2 to 5 drops of a 1 to 100 solution of nitroglycerin (if there is but little emphysema and no cardiac disorder) are recommended by Woodbury and Hoffmann.

Asaprol, 1 to 1 $^1/_2$ drachms in powder or in solution, is a new drug recommended by Lewin. Laborde's rhythmic traction of the tongue might be tried when no remedies are within reach. The organ being held by the fingers, covered by a napkin, it is drawn out at regular intervals, eighteen to twenty times a minute, imitating the respiratory rhythm.

Adrenalin administered hypodermically has given good results.

Case histories of asthmatic patients who obtained immediate relief from their paroxysms by the injection of adrenalin chloride. Theoretically this drug should be of benefit providing the attacks are due to dilatation of the capillaries of the lungs. That the adrenalin does produce effective vasoconstriction is shown by the fact that its injection is followed by palpatation of the heart and a feeling of light-headedness. In some patients there is a general blanching of the skin and visible mucous membranes, together with tremors of the extremities. These sensations never last longer than ten minutes, and are never observed where the drug is administered in proper doses. Persons with arteriosclerosis suffer more from these symptoms than those who are free from this condition. Regarding the asthmatic attack as due to an angioparesis, a dose sufficient to cause vasoconstriction is necessary to stop the attack. Doses too small to bring about this result will not relieve the patient. With fresh preparations of the drug 3 to 6 minims of a 1 to 1000 solution occasionally abort the asthmatic attack. The immediate vasoconstriction necessary to cut short an attack can only be obtained by the hypodermic method of administration. Much larger doses by the mouth will not give the effect, and sprays into the throat are inefficient. J. G. M. Bullowa and D. M. Kaplan (Med. News, Oct. 24, 1903).

2. Prevention of Paroxysm. — As already stated, the phenomena observed in the chest-walls and lungs may be due to reflex action, the primary factors of which may be located in the naso-pharyngeal tract, the ear, the digestive tract, and the genital organs.

Careful examination of all the organs becomes, therefore, imperative. The nose

and stomach are, doubtless, most frequently at fault. In the nasal cavities the lesions met with in the majority of cases are nasal polypus, deflected septum, and turbinal hypertrophy. Active measures to remove any of these abnormalities should be instituted whenever found, although they may not apparently interfere with the physiological functions of the nose.

That permanent relief is to be expected in one-half of the cases cannot be affirmed. An average of about 20 per cent., however, probably represents the cures obtained by rhinologists at large.

Disorders of digestion, by serving as preliminary factors of imperfect metabolism, very frequently act as starting-points of paroxysms in asthmatic individuals. Indeed, the majority of patients soon learn that certain articles of food and any indiscretion as to quantity or as to the time of the day at which aliments are partaken of may give rise to an exacerbation of their trouble. Experience teaches them that the greatest discretion should be observed; that easily digested food should alone be taken, especially toward evening; and that wines and alcoholic beverages had best be avoided, owing to their inhibitory influence over the various digestive processes. Gaseous liquids are also pernicious by causing dilatation of the stomach and pressure upon the overlying diaphragm. Butcher's meat, greasy soups, coffee, sweets, and other substances tending to the formation of urea are contra-indicated. Milk, fish, eggs, and vegetables (except beans and rye) should form the bulk of the patient's diet.

The treatment should, above all, be alimentary. A milk and partly vegetarian diet should occupy the first place. This succeeds where potassium iodide fails. Huchard (Revue Gén. de Clin. et de Thér. Jour. des Praticiens, Feb. 22, '96).

In four cases of asthma compression of the pneumogastric nerve, at the surface of the neck, employed. The compression was accomplished by means of a finger and yielded relief within a few minutes, even to complete disappearance of the attack of dyspnœa. A. de Miranda (Sem. Méd., xviii, p. 110).

3. Curative Measures. — The removal of whatever organic disorder that may be present, whether located in the nasal cavities, stomach, genital tract, etc., is, of course, the primary feature of the treatment of a case when the existence of any such disorder can be distinctly established. The chances of cure are greatly increased when a localized affection is present, even if only concomitantly, as successful treatment of the latter entails the removal of a disturbing element of which the sympathetic system at large, and the vasomotors in particular, bear the brunt. Diathetic affections, —syphilis, for instance,—and any of the conditions mentioned of which uricacidæmia is the most prominent type, also require active interference. Considerable improvement, and in some cases cure, may be expected if a proper diagnosis of the primary etiological factor is established and the proper measures instituted.

Treatment based on the statements of Haig and others, that the contraction of the bronchi and arterioles is often due to the accumulation of uric acid in the blood. The biurate crystals, by their points, set up a reflex irritation of the terminal branches of vagi in the bronchial mucous membrane. Frequency of attacks is in proportion to amount of uric acid. Thiolin, the laxative salt of lithium, given as follows: A teaspoonful in a cup of hot water every three hours until free catharsis results; thereafter the same dose is given once a day on rising. When urine is alkaline,

medication is omitted for two days. In addition, the diet is to be limited, strongly nitrogenous food being interdicted. G. A. Gilbert (St. Louis Med. and Surg. Jour., vol. lxviii, p. 125, 1900).

Underlying the varieties of primary disorders, to which mention has just been made, are others that may be classed as complications. These are usually present whatever may be the primary cause of the disease. Most prominent among these are: 1. The general neurosis forming the basis of the asthmatic paroxysms, which may have assumed a chronic type through depravity of the nerve-centres. 2. Inflammatory lesions of the bronchial tract, which, through the supplementary congestion induced by an unusual atmospheric condition or a dietetic error, may suddenly cause a paroxysm. 3. Malformation of the thorax, —the "barrel-chest," due to excessive distension, which may prevent the expulsion of a sufficient amount of tidal air and interfere with oxygenation,—a condition present in the great majority of cases and a potent element in the causation of suffering.

When, therefore, judicious treatment of any abnormal condition of the upper respiratory, digestive, or genito-urinary tract, or the circulatory and hepatic systems does not yield satisfactory results, it is probably due to the fact that either one, two, or all three of the conditions outlined complicate the case. In the vast majority of cases of long standing the entire symptom-complex is present: a pernicious cycle that only persistent effort on the part of the physician can command.

The neurotic asthenia may be said to be present in all cases of asthma. This is met most satisfactorily by strychnine in increasing doses, beginning for adults with $^1/_{60}$ grain after each meal and gradually bringing the dose up to $^1/_{20}$ grain, during a period covering two months.

The case should, of course, be carefully watched, and, if the physiological effects of the drug appear, the dose of strychnine should be reduced. Static electricity, by stimulating the peripheral vasomotors, greatly enhances the action of the strychnine, and, in fact, is a necessary accompaniment. Daily sittings of fifteen minutes each are required to sustain the beneficial effects obtained.

When bronchial lesions are present,—they are invariably discernible in true asthma,—the treatment should begin by a course of iodide of potassium, rapidly increasing the dose from 5 to 30 grains three times a day. To avoid, as much as possible, gastric disturbances, it should be administered in not less than a half-tumblerful of pure water at first, and in a tumblerful when larger doses are to be taken. Fowler's solution, 3 minims three times a day, generally counteracts the eruption and other unpleasant effects of iodide of potassium, and should be administered simultaneously if need be. After a couple of months the strychnine and static electricity course may be begun. Iodide of potassium is contra-indicated in cases in which there is a tendency to hæmoptysis, or when there is an infraglottic disorder.

If the opinion of Landouzy that true asthmatics not infrequently have an element of tuberculosis is well founded, there is reason to think that other toxins also may promote the asthmatic symptom-complex, and especially the streptococcic toxin. Hence an explanation of the cure of asthma in certain cases by antistreptococcic serum. Boucheron (Tribune Méd., May 4, '94).

Atropine strongly recommended in bronchial asthma. The dose at first is $^1/_{120}$ grain daily by the mouth; the dose is increased by this amount every two

or three days until the daily dose of $^1/_{16}$ of a grain is reached. Then the amount is gradually diminished, the duration of the treatment averaging four to six weeks. This should be repeated every six months, but throughout less time and with smaller doses. Carl von Noorden (Ther. Monats., H. 10, S. 539, '98).

Experience with atropine in doses of $^1/_{120}$ to $^1/_{60}$ grain, hypodermically, during the attack has been most satisfactory. It did not always control the attack, to be sure, but the action was usually extremely prompt and gratifying; the dyspnœa, in particular, soon disappearing and the distension of the lungs rapidly becoming less marked. F. Riegel (Deut. med. Woch., Oct. 12, '99).

The barrel-chest, when due to the disease, is only met with in advanced cases. But, whether present or not, the conditions acting as its causes are generally present, namely: weakness of the muscles concerned in the performance of the respiratory act, including the diaphragm. The treatment of all cases of asthma should, therefore, include measures designed to increase nutrition of these muscles and the activity of their nervous supply. Strychnine fulfills the latter objects, but it must be assisted by complementary measures designed to localize, as it were, its beneficial influence. For the superficial muscles of the chest, massage, first along the intercostal spaces, then over the large muscles, the deltoids especially; the outline of the muscles should be borne in mind and the active pressure exerted along the muscular fibres toward the arterial trunk supplying each set. For the diaphragm the faradic current alone is of service, the negative pole being applied over the course of the phrenic nerve just above the clavicle and the positive over the xiphoid cartilage. The sponges being fully moistened with salt-water and applied, the patient is directed to empty his lungs of air, then to *only inflate them partially*, and to continue this restricted respiratory act during the entire sitting, —about five minutes at first, then ten minutes. The oftener this procedure will be undertaken, the sooner will satisfactory results be attained. At home the patient will enhance the effects produced by a daily calisthenic exercise, consisting in bringing the fists up to the shoulders and approximating the elbows anteriorly as much as possible with each expiration. Chairs have been invented by means of which the exaggerated expansion of the thorax may be counteracted.

Posterior portion of chest rapped quite violently until the entire thorax is set into violent vibration. This improves the circulation, favorably influences the emphysema, and betters the nutrition of the lung. Goebel (Deut. med. Woch., Apr. 7, '92).

Asthma is due, in part, to a deficient supply of oxygen to respiratory centres; training of respiration, carried out by practicing respiratory movements needed to carry tidal air through the lungs, is recommended. Marcet (Lancet, July 13, '95).

When a fall in the barometric pressure takes place, the asthmatic subject develops and passes through a series of symptoms of an identical nature to those which are observed when men are suddenly removed from additional atmospheric pressures to the normal. This force, which differs so vastly in its intensity, established a series of symptoms which vary only in their severity and immediate results. Should death take place under any of the conditions mentioned, and the post-mortem appearances be compared with those observed in death from carbonic-acid poisoning direct, their further identity will be apparent. J. C. Bowie (Edinburgh Med. Jour., May, '97).

In case of hysterical diaphragmatic asthma faradization of the phrenics and practice in voluntary respiration were soon followed by improvement, but the dyspnœic motions returned whenever the

patient felt he was being observed. Finally, complete recovery was obtained. E. Barth (Berliner klin. Woch., Nos. 42, 43, '98).

As a result of clinical observation, following conclusions reached: 1. The spasm of the respiratory passages may be produced voluntarily by the majority of asthmatic patients and by many normal individuals. 2. Almost all asthmatics can control the spasms even during an attack, but certainly during the period of remission. 3. The muscles of the respiratory passages are either under the control of the will or may be brought under such control. As a consequence of these conclusions the importance of respiratory gymnastics for asthmatic patients is patent. The number of respirations per minute must be reduced and expirations performed slower and more completely. The spasm of the muscles will thus be controlled. The speech must be regulated and while speaking the patient must inspire slowly and deeply. The asthmatic must learn to maintain the proper tension of the muscles of the neck, chest, and abdomen. Talma (Berliner klin. Woch., No. 52, '98).

Personal method of treatment in those cases of asthma combined with cardiac dilatation consists in a modification of the Schott treatment with the inhalation twice daily of free oxygen-gas. The gas seems to relieve the paroxysms by supplying the oxygen of which the system is in need. Kingscote (Medical News, May 21, '98).

Compressed air, the patient being placed in pneumatic air-chamber in which the air has been condensed, is of great value in bronchial asthma and secondary emphysema. Unfortunately, the apparatus required is so bulky and expensive that it is hardly ever at the disposal of the physician. Expiration into rarefied air is of signal value in spasmodic asthma, the apparatuses of Waldenburg and Solomon Solis-Cohen being especially efficient for the purpose.

Rarefied compressed air used to a considerable extent, invariably with excellent results. Contra-indications: Valvular disease of the heart, extensive cardiac dilatation, fatty degeneration of the heart, or atheromatous degeneration of the arteries. Williams (Amer. Jour. of the Med. Sciences, Aug. 5, '95).

[I employ the Guillemin hydraulic apparatus, owing to the fact that no weights are required and because its diminutive size causes it to occupy but little room as compared to other instruments. SAJOUS.]

Strophanthus, 10 grains three times a day, has been credited with curative properties, but the best that can be said of this drug is that it seems to lengthen the interparoxysmal periods.

Strophanthus, in 10-grain doses, lessens the excitability of the vagus, given three times daily at intervals for some time; arrests asthmatic attacks for a long period. Drzewiecki (Le Bull. Méd., Jan. 22, '90).

Intralaryngeal injections for the purpose of reducing the catarrhal process of the bronchial mucous membrane have been followed by satisfactory results.

Intralaryngeal injections of the following solutions are used, the quantity of the solutions injected and the amount of the agents contained in each injection being in accordance with the patient's age and condition. One drachm will be sufficient for a child from 5 to 10 years of age, 2 drachms from 10 to 15; after this, from 3 to 5 drachms will suffice at each sitting.

First solution: a 5-, 10-, 15-, or 20-per-cent. solution of menthol in almond-oil.

Second solution: 2 to 5 minims of a 2 1/2-per-cent. solution of pure crystals of iodine in almond-oil, added to each drachm of the first solution.

Third solution: 5 minims of a 10-per-cent. solution of oil of hops in almond-oil added to each drachm of the first. J. C. Bowie (Edinburgh Med. Jour., May, '97).

When the asthma occurs in connection with pregnancy viburnum prunifolium is a valuable remedy. If there should be

any indication of abortion, chloral-hydrate may be administered simultaneously.

Climate is thought to bear considerable influence upon the explosion of asthmatic paroxysms. The fact is that very few cases are permanently cured by a change of residence, and that practically all are momentarily benefited by any change they may make. Thus, removal from the purest mountain-air to the dusty air of a large city is fraught with momentary relief. It is probable that the change of diet and habits has much to do with the result attained, unless the paroxysms are greatly under the influence of bronchial catarrh, when the removal from a cold and damp climate to a warm and dry one may prove of lasting benefit.

> In seeking for a climate it is well to remember that for a time immunity from attacks may be apparent, but finally acclimatization takes place and the symptoms reappear. Brügelmann (Ther. Monat., H. 2, S. 74, '97).
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> Case of a physician who changed his residence and practice several times during his life, on account of asthma, and who finally got relief by going back to the place from which he started. F. I. Knight (Boston Med. and Surg. Jour., Mar. 25, '97).
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> While Arizona stands first as a climate for all respiratory diseases, Tucson heads the list of its cities for such patients. It has an elevation of about 4000 feet; its annual rain-fall is from 8 to 10 inches; its mean average annual humidity, 36 per cent. It is free from wind, dust, and sudden changes of temperature. Robert Bell (Boston Med. and Surg. Jour., Apr. 25, 1901).

Charles E. de M. Sajous,
Philadelphia.

ASTIGMATISM.—From Gr., α, priv.; and στίγμα, a point. This word, proposed by Dr. Whewell, has been adopted, with slight modification, in all modern languages.

> Astigmia, from α, and στίγμή, is proposed to replace it, as being etymologically better and shorter, although some of the derivative words would be longer. Georges Martin (Ann. d'Ocul., Mar., '95).

Definition. — That error of refraction by reason of which rays, coming from a single point and passing through the refractive surfaces of the eye, are not turned toward a single point, and, therefore, cannot be perfectly focused on the retina.

Irregular Astigmatism.

Definition.—The form of astigmatism arising when one or more of the refractive surfaces of the eye is irregular; so that rays passing through different parts of these surfaces are turned in various directions and can never be brought to a perfect focus.

Symptoms.—There is imperfect vision, the blurring being proportioned to the degree of the defect and the size of the pupil, and affecting the seeing at all distances and all times. An eye subject to this defect is permanently "weak," cannot attempt work requiring very accurate seeing, and is liable to be strained in reading, sewing, etc. The irregularity of surface is generally accompanied by more or less haziness or opacity. This may be the opacity remaining in the cornea when irregular astigmatism has been caused by corneal inflammation, or it may be an opacity of the lens, when such astigmatism is the forerunner of cataract.

Pronounced irregular astigmatism causes *monocular diplopia*, or *polyopia*. A lamp-flame or the moon at night is seen multiplied, the different images of it usually overlapping each other more or less. It also shows itself by the distortion of letters, and in the appearance

of additional lines about or upon them, plain type being made to appear like fancy type. The "rays" which appear to proceed from a point of bright light, as a star or a distant electric lamp, are due to irregular astigmatism. An eye free from astigmatism would see a star as a mere point of light.

Etiology. — Some irregular astigmatism is present in all normal eyes. When it causes no impairment of vision, below the usual standard of 20-xx, it is called normal. Normal irregular astigmatism is generally caused by the inequality of curvature in the periphery of the dilated pupil, this being cut off when the pupil contracts.

> The form of irregular astigmatism in which rays piercing the cornea in the same meridian, but at different distances from the centre, are differently refracted, while rays piercing it in different meridians, but at the same distance from the centre, are equally refracted, is called the "symmetrical aberration" of the eye. It is "positive" if the rays are most refracted at the edge of the pupil. This commonly depends upon increased curvature of the periphery of the lens. It is "negative" when the rays are least refracted at the edge of the pupil, from the flattening of the periphery of the cornea. Conical causes a form of high negative aberration. E. Jackson (Trans. Amer. Ophthal. Soc., '88).
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> Even when not excluded by the iris, such astigmatism may not cause imperfect vision, because the distinct retinal image may be formed from a small part of the light entering the eye; and, while additional unfocused light renders accurate vision slightly more difficult and tiresome, it does not prevent it. E. Jackson (Jour. of Amer. Med. Assoc., Sept. 1, '94).

Irregular astigmatism may be due to irregularity of the surface of the cornea, as from abrasion or superficial ulceration.

> Irregularity of the corneal surfaces and of the layer of mucus covering the cornea, which acts as a portion of the cornea in the refraction of light, may be caused by partial closure of the lids with pressure of the lid-margins upon the cornea, —that constriction of the lids which is designated in French *clignement*. The lid-margin resembles, somewhat, the rubber scrapers used for cleaning windows, and constriction of the lids causes this prominent margin to make a groove on the cornea. Brief constriction merely displaces the viscid covering of the cornea, and irregular astigmatism due to it disappears with a single sweep of the lids in winking. Prolonged constriction causes a groove in the corneal substance, the effects of which are rendered more evident by winking, and which is quite slowly effaced. George J. Bull (Trans. Eighth Inter. Oph. Cong., p. 107).

General bulging of the cornea is commonly not uniform and gives rise to irregular astigmatism, the common form being conical cornea; but the most common cause is incomplete restoration of the corneal tissue to normal after keratitis.

Treatment. — With irregular astigmatism following keratitis there is always, at first, haziness of the cornea; and probably, remedies for corneal opacity improve vision partly by lessening irregular astigmatism.

> Conical cornea, if extreme, may be greatly improved by making a paracentesis at the apex of the cone with galvano-cautery needle. In one case vision improved from $^{4}/_{200}$ to $^{20}/_{50}$ with lenses. R. D. Gibson (Trans., Section on Oph., Amer. Med. Assoc., '92).

In a few cases dilatation of the pupil may improve vision by admitting light through a better portion of the cornea or crystalline lens. Iridectomy is applicable in some cases for the same purpose. Contraction of the pupil often makes vision better by lessening the areas of diffusion. Solutions of pilocarpine, 1 to 500, or eserine, 1 to 2000, may be instilled for this purpose. Stenopaic spec-

tacles improve vision, but interfere too much with the field of vision to be of much practical value. Hyperboloid lenses have been used for conical cornea, but rarely with enough advantage for the patient to continue their use. For the mass of cases the correction of regular astigmatism commonly associated with the irregular, and the use of spherical lenses that will prevent the straining of accommodation, is the only available optical treatment.

Regular Astigmatism.

Definition.—It is the astigmatism that can be corrected by a cylindrical lens.

Symptoms.—It causes the blurring of some or all lines looked at. The eye is able to see with perfect clearness only the lines running in one direction at any one time, although by changing its accommodation it may be able to see clearly lines running at right angles to the first. These two directions in which lines may be seen clearly, the "principal meridians," may be perceived by the patient, although usually they are only recognized when the eyes are carefully tested. A certain adjustment of the power of accommodation renders lines equally blurred in all directions. Astigmatism may thus cause imperfect vision; but very often the imperfection has never been noticed by the patient. Generally some form of eye-strain, from the effort to focus clearly the lines running in the different directions which all objects present, or to recognize from imperfect retinal images the real form of an object, gives rise to the symptoms complained of. These are weakness of the eyes, headache, pain in the eyes on use, inability to use them long, excessive lacrymation, photophobia, nervousness, twitching of the eyelids, and even more serious nerve disease.

Astigmatism usually co-exists with hyperopia and myopia, and a portion of the symptoms may be due to one of these.

> In the majority of cases with low degrees of hyperopia it is sufficient to correct the astigmatism, and the correction of astigmatism removes the troublesome symptoms that were assumed to depend on muscular insufficiency. D. B. St. John Roosa (Ophthal. Review, Oct., '91; Annals of Oph. and Otol., '92).
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> The correction of astigmatism alone many times may give marked relief, but it is better to give full correcting glasses so that the refraction of the dioptric system including the glasses show approximate emmetropia. S. D. Risley (Annals of Oph. and Otol., July, '92).

The eye-strain caused by astigmatism is probably a very important factor in the development of myopia.

> Among 2000 eyes 9 per cent. were simply hyperopic, but only $^1/_8$ of 1 per cent. showed simple myopia. In the other myopic eyes there was also astigmatism. F. W. Marlow (N. Y. Med. Jour., July, '95).
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> The correction of errors of refraction, particularly astigmatism, has greatly decreased the prevalence of myopia, particularly of high myopia. In Philadelphia in the last twenty years the percentage of eyes requiring myopic corrections is diminished from 25.4 to 15.2 per cent. S. D. Risley (Trans. Amer. Oph. Soc., vol. vii, p. 168).
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> Among 869 patients, about 70 per cent. of whom had astigmatism, there were 60 per cent. suffering from headache, 20 per cent. aching and pain in the eyeballs, 11 per cent. twitching or spasm of the lids, and 11 per cent. had inflammatory symptoms. H. Bert Ellis (Trans., Section on Oph., Amer. Med. Assoc., '95).
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> Among 4000 cases of ocular headaches, 73 per cent. had astigmatism. Patients with high degrees of astigmatism are apt to go through life without complaining of eye-strain, while a larger number of persons suffer who have only the lowest degrees of astigmatism. This may be partly because low degrees of astigmatism are more common than the high

degrees; and probably, also, because those with high astigmatism early learn to save their eyes, while persons who are able to see perfectly use and abuse their eyes more freely. W. F. Mittendorf (Trans. Amer. Oph. Soc., '95).

In recent examination of personal case-book it was noted that a large number of cases that had been examined a few years ago recently on re-examination showed marked changes in the astigmatism. In some cases a change from emmetropia to myopic astigmatism had occurred, others of gradually increasing myopic astigmatism, and still a third class in which there had been an increase in the hypermetropic astigmatism. Hotz (Phila. Med. Jour., July 16, '98).

Many observers believe that astigmatism against the rule, or astigmatism with the meridian placed obliquely, causes more annoyance than astigmatism of the usual form, in which the meridian of greatest refraction is vertical. This latter may be due to the fact that the astigmatic eye can see perfectly only the lines that run in the direction of one of its principal meridians, and that most of the lines which we wish to distinguish are either vertical or horizontal.

The eye with oblique astigmatism sees vertical and horizontal lines rotated, and for the two eyes to work together in binocular vision this rotation of the images must be compensated by rotation of the eyeball through symmetrical action of the oblique muscles. Such an action may cause symptoms of eye-strain. G. C. Savage (Oph. Record, July, '91).

In any given cases of astigmatism lines perpendicular to each other have their images rotated in opposite directions. It is, therefore, impossible by rotation of the eyeball to make all the lines of the image in one eye correspond to the lines of the image in the other. Compensatory rotation of the eye is, therefore, only necessary when the lines running in some one direction are decidedly predominant over lines running in other directions. H. Wilson (Arch. of Oph., July, '94).

Uncorrected astigmatism has been regarded as interfering with the use of various optical instruments.

A careful consideration of the optical theory of the microscope shows that, on account of the "penetrating power" of that instrument, astigmatism interferes but little with its use. Only when the astigmatism is of high degree and a low power of microscope is employed is it necessary to consider it at all, or resort to correcting lenses. With the high powers of the microscope even the high grades of astigmatism cause no distortion or blurring of the image. Woodruff (Jour. Amer. Med. Assoc., Nov. 24, '94).

Etiology. — Astigmatism is caused by a lack of symmetry in the curvature of the refracting surfaces of the cornea or crystalline lens, or an oblique position of such surfaces with reference to the visual line. The statement still sometimes made, that obliquity or distortion of the retina is capable of causing astigmatism, merely betrays the ignorance, of him who makes it, of the nature of the defect. Astigmatism caused by the cornea may be partly or wholly corrected by an opposite astigmatism caused by the crystalline lens. The wide use of the keratometer (ophthalmometer) of Javal has furnished extended statistics regarding corneal astigmatism, which, by comparison with the total astigmatism of the eye, also indicates the astigmatism due to the crystalline lens.

Examination of 500 eyes with the ophthalmometer showed that in 6 per cent. of all cases the corneal astigmatism corresponded with the total astigmatism both as to amount and as to the direction of the principal meridians. In 10.6 per cent. additional the amount of corneal astigmatism exactly equals the total, and in 41.6 per cent. the difference equals 0.50 dioptre or less. Of the 77.4 per cent. in which corneal astigmatism does not correspond with the total, the

former is in excess in 62 per cent. and the latter in 15.4 per cent. In 34.6 per cent. the instrument indicates the direction of the total astigmatism. E. Jackson (Annals of Oph. and Otol., Oct., '94).

In 150 eyes affected with astigmatism the amount measured by the ophthalmometer was greater by 0.50 dioptre, on an average, than that found subjectively by glasses, during paralysis of the accommodation by atropine or scopolamine. Andogsky and Dolganoff (Ann. d'Ocul., Nov., '94).

Yielding of the sclerotic to intra-ocular pressure does not always occur at the posterior hole of the eye. In most cases of astigmatism there is evidence of this yielding at some portion of the globe, and the corneal astigmatism is secondary to this. Where the astigmatism is very high, the yielding of the sclerotic is chiefly lateral and localized. And, in cases of conical astigmatism in which the surface of the cornea is distorted so as to approach the surface of a cone with its apex to one side, the staphyloma is to be found in the neighborhood of the cornea. R. D. Batten (Oph. Review, Jan., '97).

Measurements of 4270 eyes with the ophthalmometer show that, on the average, the refraction of the vertical meridian is about 0.78 dioptre greater than the horizontal, and that $^7/_8$ of all eyes show corneal astigmatism of between 0.25 and 1.25 dioptres. Astigmatism of high degree is apt to be associated with other abnormalities, is unequal in the two eyes, and has its meridians obliquely placed. There is, also, a marked tendency to heredity of the corneal curvature and astigmatism. A Steiger (Arch. of Oph., p. 254, '97).

The direction of the principal meridians of astigmatism have been frequently studied in the hope of throwing light on the etiology of the defect.

In 1000 cases of binocular astigmatism the meridian of greatest curvature was vertical in 60 per cent. and symmetrical in the two eyes in 84 per cent., while, if differences of 5 or 10 degrees in direction had been disregarded, the proportion of cases of approximate symmetry would be considerably higher. H. Knapp (Trans. of Amer. Oph. Soc., '92).

In 2500 cases the direction of the principal meridians were found: symmetrical in 1307 cases; asymmetrical in 458; heteronymous—that is, one meridian at zero and a corresponding meridian of the other eye at 90 degrees—in 173 cases; and homonymous—that is, with the principal meridians parallel, but neither vertical nor horizontal—in 41 cases. In the cases of symmetrical astigmatism the meridian of greatest curvature was found vertical in 57 per cent.; within 15 degrees of vertical in 20 per cent.; horizontal in 12 per cent.; and within 15 degrees of horizontal in 4 per cent. S. D. Risley and J. Thorington (Trans. of Sec. on Oph., Amer. Med. Assoc., '95).

Extensive wounds or incisions of the cornea give rise to permanent change in the corneal curvature and astigmatism. This is most noticeable after cataract extraction. The astigmatism is highest a few days after the corneal wound has closed, and from then on slowly diminishes until usually within three months, but sometimes later, it becomes stationary. The changes of corneal curvature are flattening of the cornea at right angles to the incision, and increased curvature in the direction of the line joining the ends of the incision.

This is the natural result of diminished resistance along the line of the incision, allowing cornea to give before the intra-ocular pressure and bulge at this point. E. Jackson (Trans. Pan-Amer. Congress, vol. ii, p. 1430).

After operation the astigmatism diminishes by the increasing approximation of both meridians to their curvature before operation. With complicated wounds the astigmatism is always greater, and the decrease from the original amount is less than in cases of normal healing. The chief causes of traumatic astigmatism are the intra-ocular pressure and the tonic contracture of the extrinsic ocular muscles. W. Dolganoff (Arch. of Oph., p. 250, '97).

Case in which a marked temporary

change in the astigmatism had been produced by pressure of a chalazion. Norton (Phila. Med. Jour., July 16, '98).

Belief that cocaine has the effect of producing transient astigmatism. Grigg (Phila. Med. Jour., July 16, '98).

Attention called to the temporary astigmatism, often considerable in amount, that accompanies blepharitis and is due to lid-pressure. Wurdemann (Phila. Med. Jour., July 16, '98).

Diagnosis. — Astigmatism is detected and measured by all of the various methods of determining the refraction of the eye, and should be sought by more than one method in any given case. The chief reliance is to be placed on the keratometer (ophthalmometer), skiascopy, and the test-lenses.

The keratometer measures only the corneal astigmatism, which commonly predominates and approximately corresponds to the total astigmatism. Its value is mainly that it makes an important suggestion as to the presence, degree, and direction of the astigmatism, which, when followed up by other methods of measurement, effects a saving of time. Skiascopy measures the total astigmatism of the eye, usually with the greatest accuracy of any method. Committee on Objective Tests for Ametropia (Trans., Section on Oph., Amer. Med. Assoc., '94).

Latent astigmatism may, in many cases, be made manifest and measured without a cycloplegic, by giving lenses, which correct the manifest only, to be worn a day or two, when additional astigmatism will be manifest, which is also to be corrected; and so on, until the latent trouble is unmasked. H. M. Starkey (Trans. Sec. on Oph., Amer. Med. Assoc., '95).

In determining astigmatism make the meridian of least refraction slightly myopic, and determine the astigmatism by concave cylindrical glasses, afterward ascertaining the spherical glasses. In other words, make the astigmatism myopic, and then measure it in the remote zone, generally by distance tests. George J. Bull (Oph. Review, p. 275, '95).

Whether astigmatism is even partially corrected by unequal contraction of different parts of the ciliary muscle, or is not so corrected, must still be regarded as uncertain.

In two medical students with normal vision the vision remained good with strong cylinders, but after the use of atropine no cylindrical lens whatever could be overcome. To prevent error the eyelids were held so that they could not press on the globe. From this experiment it is inferred that the power of accommodation enables the eye to overcome astigmatism either by change in the curvature of the crystalline lens or by tilting it. Guilloz (Arch. d'Oph., vol. xiii, p. 676).

When the retina lies half-way between the anterior and posterior focal lines, it receives small circles of diffusion, which allow lines running in different directions to be seen with equal clearness. Placing before one eye fine print, and before the other cross-threads, when the fine print was read the threads were only seen clearly if accurately placed at the point for which the eyes were focused. When reading with eyes made astigmatic, it was found that the astigmatism was corrected by bringing these smaller circles of diffusion on the retina. By extremely fine threads placed to correspond with the meridians of astigmatism it was demonstrated that under the most favorable circumstances no compensatory action in the ciliary muscle was shown. C. Hess (von Gräfe's Archiv, Part II, '96).

Treatment.—For regular astigmatism the usual remedy is the wearing of cylindrical lenses, which should correct the full amount of the astigmatism and be worn constantly. Any case of astigmatism may be thus corrected by a convex cylindrical lens with its axis placed parallel to the meridian of greatest curvature, or by a concave cylindrical lens with its axis placed perpendicular to this, or by two lenses of proper strengths with their axes respectively parallel to

the two meridians. As may readily be demonstrated mathematically or by trial, the optical effect of any possible combination of cylindrical lenses may be produced by the proper single cylindrical lens combined with the proper spherical lens.

Javal has pointed out that sometimes the meridians of greatest curvature are not perpendicular to each other. Two cases are reported, corrected by crossed cylinders with their bases obliquely placed parallel to these oblique meridians. Roure (Arch. d'Oph., Apr., '96).

The fact that corneal incisions change the corneal curvature has suggested their employment for the correction of astigmatism.

Ten observations show the possible diminution and relative curability of astigmatism by incisions in the cornea. The change from one incision was about 1 dioptre. When the incision is not carried through the cornea so as to permit the escape of the aqueous humor, contrary to what takes place after cataract extraction, iridectomy, etc., there is an increase of the corneal curvature in the direction of the incision. Lucciola (Arch. d'Oph., Oct., '96).

A case is reported by Dr. Bull, of Paris, in which a complete tenotomy of the external rectus for the correction of an exophoria produced the unexpected result of curing a progressive myopic astigmatism against the rule, or, as Dr. Bull prefers to call it, "inverse" astigmatism, where the greatest curvature of the cornea is in the horizontal meridian. If this astigmatism had been measured by the retinoscope alone, the relief obtained might reasonably have been ascribed to relaxation of an irregular spasm of the ciliary muscle, particularly as the degree of astigmatism appeared to be inconstant, but the ophthalmometer showed that the astigmatism was produced by the difference in the curvatures of the vertical and horizontal meridians of the cornea. Three days after the operation the ophthalmometer showed that this difference in the curvatures of the two meridians of the cornea had disappeared, while at the same time the subjective astigmatism had gone and the vision of the eye had risen to normal. Because of this record the astigmatism and poor vision before the operation cannot be ascribed to hysteria any more than to ciliary spasm, and the conclusion is necessary that some corneas have their form easily influenced by the tension of the external ocular muscles. A corollary to this is that when a surgeon has to deal with such a cornea he may be able, not only to cure an astigmatism by an operation on these muscles, but also to produce an astigmatism or increase one already present by an incautious interference.

Dr. Bull's observation opens the way to investigations which may prove of essential service in some obscure conditions. If an etiological connection between progressive astigmatism, or the position and relative tension of the ocular muscles, and glaucoma can finally be demonstrated, he will be entitled to the credit at least of having made the first suggestion, and it is to be hoped that the results of the investigations he proposes to make may be as brilliant as the result he obtained from the operation he has described. At the same time it is to be hoped that this operation will be tried conservatively and its limitations clearly defined before it is brought into general use, for "such an operation for the cure of astigmatism, should be undertaken only in very exceptional cases," while the damage which may be done by incautious or unskilled interference with the muscles of the eye has been demonstrated to be very great. Editorial (New York Medical Journal, Feb. 7, 1903).

EDWARD JACKSON,

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ATHETOSIS. — (Lat.). From Gr., ἄθετος : α, priv., and τιθέναι, to bring into position.

Definition.—A nervous disorder characterized by involuntary movements of the fingers and toes, apparently of a uni-

form and systematic character. It may be partial, affecting a limited portion of the body, or general, the movements being wide-spread. The latter form is also termed "idiopathic."

Symptoms.—The striking peculiarity of this disease, first described by W. A. Hammond, of New York, is that the parts concerned in the spasmodic movements, usually the fingers and toes of the one side, are constantly moving, though to a limited degree, during sleep, independently of the patient's will. The fingers are alternately flexed and extended with varying degrees of adduction and abduction, and with a tendency to distortion. The movements are not always limited to the fingers and toes, however, the muscles of the arm and leg, and sometimes those of the face, taking part in the spasmodic seizures in a small proportion of cases. In these cases the arm is swung to and fro in regular rhythmic movements and the alternate contractions and relaxations of the facial muscles give rise to grimaces. These movements are often preceded, or accompanied, by other symptoms of cerebral disease, especially epileptic seizures and impairment of the intellect. This occurs most frequently in middle-aged men of intemperate habits. Hemianæsthesia and other perversions of sensation are often present.

The idiopathic form is usually bilateral; the gait is characteristic in the majority of cases; they seem constantly to be on the point of falling, while violent contortions of the extremities occur simultaneously.

Case in which, at every attempt at motion, hand, fingers, legs, and feet slowly flexed. R. M. Phelps (Inter. Med. Mag., Feb., '95).

Etiology. — The etiology of this affection is obscure. Falls, compression of the head during birth, cerebral hæmorrhage, fright, alcoholism, syphilis, and cerebral growths are among the most prominent factors. Heredity has been clearly ascertained in a number of cases.

Case of athetosis affecting principally the left hand of a woman aged 43 years. The disease commenced in childhood, after a fall, which caused no other disturbance. Von Bonsdorff (Finska Läkaresällskapets Handlingar, B. 30, H. 3).

Case of acute hemiparesis with hemiathetotic movements, following excessive use of the arms for two days and two nights in a handicraft. Lowenthal (Deutsche med. Woch., Apr. 11, '89).

Three cases of hemiathetosis in a young child, and of double athetosis in a woman and a young boy. Archibald Church (Rev. of Insan. and Nerv. Dis., Mar., '92).

Case of bilateral athetosis in a man of 43 years, formerly insane and addicted to alcohol, in whom the disease developed gradually, beginning at the extremities, and later on involving the neck, the face, and finally accompanied by complete aphasia. Parsons Norbury (Med. Fortnightly, Apr. 15, '92).

[This case is interesting, as it shows that double athetosis is not always accompanied by imbecility, and that it does not always date from early infancy. Bourneville and Sollier, Assoc. Eds., Annual, '93.]

Case of athetosis which, like so many cases of the kind, developed after an apoplectic attack when the patient was a child (3 years old), and had persisted now for twenty-three years. The movements do not stop altogether during sleep. Report of Professor Baelz (Corres. Ed. of the Annual, Tokio, Japan).

Case of hemiathetosis in a young child, following measles, supporting the personal opinion, given in 1887, that the disease originates in children in infectious diseases, either of unknown or of well-known origin, such as the eruptive fevers of infancy. Roberto Massalongo (Riforma Med., Sept. 3, '92).

Double athetosis following birth or occurring in early infancy belongs to the group of infantile cerebral diplegias. The common feature of these affections is premature birth or difficult labor, and the common lesion is arrested development of the pyramid. Lannois (Le Bull. Méd., Apr. 19, '93).

Typical athetotic movements after sudden fright in a child. Rauzier and Cazalis (Le Bull. Méd., Nov. 28, '94).

Cases in mother and child. Symptoms exactly alike. Oppenheim (Berliner klin. Woch., Aug. 26, '95).

Double athetosis in a syphilitic woman. Father epileptic. Brandeis (Le Bull. Méd., Sept. 1, '95).

Case of functional athetosis, apparently of traumatic origin. The patient—a girl, aged 9 years, with a negative family history—had fallen from the rings while exercising in a turning-school, but apparently suffered no bad effects from the fall. Inattention, carelessness, and lack of desire for study first appeared, followed by great difficulty in holding any object in her left hand. There were also certain peculiar, involuntary movements of the left upper extremity, more marked in the hands and fingers, which were always brought on by attempts at voluntary movements, and which were never present during sleep. Left foot dragged slightly when walking. Pupillary and patellar reflexes were normal; no impairment of sensation; no contraction or atrophies; muscular power in left hand and arm did not seem impaired, though there may possibly have been a slight degree of paresis, and muscular development was normal. Heart-sounds were normal. Examination of eyes negative. Iron and arsenic administered. In five weeks the athetoid movements had disappeared. E. G. Thomas (Medicine, Aug., '97).

Pathology.—Athetosis is closely allied to posthemiplegic chorea, and is usually due to some lesion of the optic thalamus: a thrombus or tumor and particularly to embolism.

Case of athetosis, or choreic spasm of the right side of the body, due to a tumor of the left optic thalamus and adjacent internal capsule. All the cases of athetosis and chorea following hemiplegia are due to lesions in this vicinity. Seguin (Boston Med. and Surg. Jour., July 17, '90).

Autopsy of case upon which W. A. Hammond's description of the disorder was based. The portion involved in the lesion had consisted of fibrous connective tissue. Topographically, the lesion was a lengthy one in the antero-posterior direction, parallel in its short axis with the internal capsule. Its posterior end had invaded the stratum zonale of the thalamus on its posterior third and the posterior half of the internal capsule. In its anterior extension it had crossed the capsule, invading the posterior third of the outer lenticulus. The author called attention to the fact that this case was further evidence of his theory that athetosis was caused by irritation of the thalamus, the striatum, or the cortex, and not by a lesion of the motor tract. G. M. Hammond (Boston Med. and Surg. Jour., July 17, '90).

In those cases of athetosis in which a lesion has been found, if it has been located in the posterior limb of the internal capsule or in the adjacent portion of the optic thalamus these are the sites of sensory organs. These lesions could not produce the symptoms of athetosis by direct irritation of the neighboring pyramidal tract, for, if they would, the abnormal movement would be more common in the lower or internal extremities, whereas the reverse of this is the case. Frank Fisher (Med. Age, Mar. 25, 1900).

Lesions of the lenticular nucleus have also been found, consisting mainly in softening.

Case of athetosis, following a left-sided hemiplegia, in which the autopsy revealed four or five points of softening of the size of the head of a pin in the right nucleus lenticularis, and an old hæmorrhage the size of a hazel-nut lying between the body of the nucleus caudatus and the optic thalamus, and involving the knee of the internal capsule of the right side. Sabrazès (Jour. de Méd. de Bordeaux, Oct. 6, '89).

Case, in a young girl of 12 years, dating from birth, of double athetosis, with autopsy. An absence of the corpus callosum and of the floor of third ventricle was observed. The left temporal lobe was retracted, and the lenticular nucleus softened and completely bare. At the extremity of the lobe there was an old abscess; capacity about one ounce. In the right temporal lobe there was also a small cavity, the seat of a former abscess. Athetosis is a pathological entity. Lesion of the lenticular nucleus is met with in the majority of cases. J. Wright Putnam (Jour. of Nerv. and Mental Dis., Feb., '92).

Case proving that athetosis is not due to irritation of the lenticular nucleus, but of the neighboring pyramid. It also confirms the opinion of Schiff that the striated body exercises no motor function. Combe (Revue Méd. de la Suisse Rom., Oct., '92).

The motor regions of the cortex are thought, by some observers, to at least be implicated in the pathological process.

The lesion of athetosis is undoubtedly in the cortex of the brain, and the best success may be obtained from galvanism there and also to the head. Rienzi (Gaz. degli Osp., '86).

Four cases of hemiathetosis in which the movements ceased during profound sleep, but persisted to a moderate degree during light sleep, tending to indicate that the point of origin of the movements of athetosis lies in motor regions of the cerebral cortex, although many autopsies have shown a lesion of the anterior portion of the internal capsule in such cases. Eulenberg (Wiener med. Presse, Feb. 24, '89).

There may be a lesion of the cerebral convolutions, with descending degeneration; so that double athetosis may be regarded as a cerebro-spinal affection. The abnormal movements are caused by an irritation of any portion of the motor tract. Massalongo (Le Progrès Méd., Jan. 18, Oct. 11, '90).

In fourteen cases of athetosis in which autopsies have been made, foci were found seven times in the striatum, four times in the thalamus, twice in the pons, and once in both thalamus and striatum. In three other cases only cortical lesions were reported, but the possibility of involvement of the basal ganglia has not been excluded in these. In two reported cases of paretic dementia with athetosis the lesions were limited to the cortex; personal case in which there was intense atrophy of the thalamus attributed mainly to the involuntary movements. The cortical lesions did not differ from those seen in many cases of general paralysis without athetoid movements. The degeneration of the pyramidal tract was equally intense above the motor decussation. M. Sander (Neurol. Centralb., No. 7, '97).

Diagnosis.—There is no absolute difference between athetosis and posthemiplegic chorea. If the lesion be acute, hemichorea is produced; if chronic, hemiathetosis. In chorea the movements are sudden and involuntary; in athetosis they are slow, and ordinarily do not interfere with voluntary acts, except to lessen their rapidity. (Rienzi.)

Study of muscular shocks and the faradic electrical reactions in a patient attacked with complete left hemiathetosis, the face being included. The muscular tonus was exaggerated by the galvanic current. The form of athetotic contraction greatly resembles that of contracture, whence its greater importance than in choreiform movements. There is inequality in the muscular tonus, shown by faradic reaction, which arises, doubtless, from the irregular, spontaneous contractions of the muscles. Domenico Cappozzi (Riforma Med., Aug. 25, '92).

Treatment.—Although this disease is regarded as incurable, functional cases have been reported in which arsenic and iron, with bromide of potassium, have brought about satisfactory results. The galvanic current, the positive pole being placed over the brachial plexus and the negative on the neck, has been recommended by Krafft-Ebing. Hammond

has obtained good results from nerve-stretching.

> Case treated at first with potassium bromide, afterward with arsenic, and blisters were applied behind the right ear. The movements gradually ceased. The patient was quite well in three weeks and had no relapse. Macaldowie (Brain, July, '88).
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> Treatment lasting six weeks, and consisting of 1 ½ drachms of bromide of potassium daily, and the stabile application of the galvanic current of 2 milliampères, the positive pole on the brachial plexus, the negative on the neck, brought about a temporary cure, which would probably have been permanent had the treatment been continued longer. Krafft-Ebing (Wiener klin. Woch., Apr. 18, '89).
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> Marked case in which three months' rest in the hospital, electrical treatment, and the administration of codliver-oil, arsenic, and iron improved affected muscles very much. Strychnine was found to increase the rigidity. Since leaving the hospital, however, the paralysis and the wasting have made steady progress. Michell Clarke (Bristol Medico-Chir. Jour., June, '97).

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ATROPINE. — Atropine (atropina of the U. S. Ph. and Br. Ph.; atropinum of German Ph.) is an alkaloid obtained from the leaves and roots (bark of the root) of the deadly-nightshade (*Atropa belladonna*, L.). It occurs in white, acicular crystals, or in white, amorphous powder (turns yellow upon exposure to the air) of bitter, acrid taste and decided alkaline reaction; is soluble in 130 parts of water, 3 parts of alcohol, 16 parts of ether, 4 parts of chloroform, and in 50 parts of glycerin. It melts at 239° F. Atropine forms salts, when combined with acids, among which are the hydrochlorate, nitrate, salicylate, and sulphate; these salts are generally used on account of their greater solubility and neutral reaction.

> Atropine and hyoscyamine are practically identical, and both atropine—heavy atropine—and hyoscyamine—light atropine—can be obtained from either belladonna or hyoscyamus. The tendency, nowadays, is to use the term "heavy" atropine in place of atropine, and "light" atropine in place of hyoscyamine. The difference between them is purely chemical, and pharmacologically the two products are identical.
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> These discoveries necessitate a considerable modification in the classification of the alkaloids originally adopted. The most recent views on the subject are expressed in the following table:—

Belladonna contains			Atropine.
Hyoscyamus contains	Hyoscyamine=		Atropine.
	Hyoscine	Scopolamine	Scopolamine.
		Hyoscyamine=	Atropine.
Stramonium contains	Atropine		Atropine.
Daturine	Hyoscyamine=		Atropine.
Scopolia contains			Scopolamine.
Duboisia contains Duboisine=Hyoscyamine=			Atropine.

> This arrangement considerably lightens our labors, for, instead of having half a dozen alkaloids to consider, we have now only two. William Murrell, of London (Med. Brief, Jan., '98).

Atropine is chemically incompatible with the alkalies, tannin, and the salts of mercury; it is physiologically incompatible with morphine (opium), pilocarpine, muscarine, aconitine, and eserine (physostigmine).

Dose and Physiological Action.—The usual dose of atropine given internally is from $^1/_{120}$ to $^1/_{60}$ grain. The maximum single dose is $^1/_{20}$ grain. The physiological action has been observed and described by John Harley. If $^1/_{120}$ grain be injected beneath the skin of a healthy adult, there will be noticed, after 10 to 20 minutes, a quickening of the pulse, and generally a small increase in volume and power. This change will be very decided if the pulse was previously slow and feeble. The increase in the number of pulse-beats will generally amount to 20 per minute; it will

take place suddenly, and attain its maximum within one or two minutes. In about half an hour a gradual decline takes place and the heart soon returns to its usual state, and continues to beat as quickly and powerfully as before. Just as the pulse rises, a slight giddiness is often perceptible. Usually these will be the whole of the symptoms; but, in weak and delicate adults, a feeling of dryness of the mouth and throat, and, at the end of an hour or two, a slight dilatation of the pupil, in a subdued light, will be superadded.

When $^1/_{60}$ grain is used, the acceleration of the pulse will be found to range between 20 and 60 beats, the rise being attended by considerable giddiness and waviness of the vision. The patient walks cautiously, and with an inclination to unsteadiness. After 20 to 40 minutes he will complain, with some huskiness of voice, of great dryness of the throat and mouth; and the anterior part of the tongue or the whole of the dorsum, excepting a wide margin, will be found dry, brown, and rough. The hard palate and, in many persons, the soft palate also, will be perfectly dry and glazed. There will be more or less somnolency, and sometimes a little flushing of the face. The dilatation of the pupils will amount to $^1/_7$ or $^1/_6$ inch.

The effects of $^1/_{48}$ grain (a full medicinal dose) are as follow: After 10 or 15 minutes an acceleration of the pulse from 20 to 70 beats; no apparent change in volume, but a decided increase in the force of the cardiac contractions and of the arterial tonus; a general diffusion of warmth, a slight throbbing or heaving sensation in the carotids, and a feeling of pressure under the parietal bones; giddiness, heaviness, drowsiness, or actual sleep, with great tendency to dreamy delirium, and, in women, slight occasional startings; complete dryness of the tongue, roof of the mouth, and soft palate, extending more or less down the pharynx and larynx, rendering the voice husky, and often inducing dry cough and difficulty in swallowing; parched lips, occasional dryness of the mucous membranes of the nose and eyes, and increasing dilatation of the pupils. After about two hours the dryness of the mouth is relieved by the appearance of a viscid, acid secretion of an offensive odor, like the sweat of the feet; the mouth becomes foul and clammy, and a bitter, coppery taste is complained of; but as moisture returns to the mouth, the pulse is observed to fall, and it now rapidly regains its ordinary rate and character. The pupils have now reached their maximum dilatation and measure,—about $^1/_5$ inch; but, when exposed to bright light, they will still contract to $^1/_4$, $^1/_6$, or even $^1/_8$ inch, according to their original size. Slight elevation of surface-temperature is noticed during the action of the medicine, rarely exceeding 1°, and a still less elevation of the internal temperature of the body. No difference will be observed in the rate of the respiration, except (in nervous women) a little emotional excitement on the sudden accession of the giddiness. The breathing will be tranquil, the patient occasionally heaving a deep sigh, and still oftener taking a prolonged yawn, as he sits still in a dull, apathetic or drowsy condition. After the pulse has resumed its ordinary rate, and the mouth has become moist, the giddiness and drowsiness pass off, and the patient appears tolerably lively and brisk in mind and body. But he will himself continue to feel for some hours longer such languor of body and mind as will render him disinclined for, or even incapable of, active bodily or mental exertion. Slight dimness of

vision also remains, and the patient is unable to thread a needle, or even to read.

If larger doses be given, there will be superadded a distressing fluttering sensation in the cardiac region, slight delirium; exquisite sensibility of hearing, and frequent illusions of this sense also; staggering, or complete inability to walk; insomnia, restlessness, and frequently great nervous agitation of mind and body. Nausea and headache are rare and exceptional consequences of the subcutaneous use of atropine, but sometimes follow when given by the stomach in full doses.

Certain conditions modify the action of atropine. Children are more tolerant of the drug than adults, and in this respect resemble the lower animals; and while acceleration of the pulse, dilatation of the pupils, and dryness of the mouth are more readily induced in them, cerebro-spinal effects—giddiness, drowsiness, sensory illusions, and unsteadiness of gait—are only developed after a very large dose. Pregnancy appears to diminish the activity of atropine. The weak, and those of excitable temperament, are more readily and powerfully influenced than the strong. In renal disease, when the secretion of urine is diminished, or only moderate in quantity, the effects of atropine are readily induced and considerably prolonged; in persons with unusually active kidneys the action of the drug is less pronounced. While atropine in contact with caustic soda and potash is decomposed in the course of two or three hours, these bodies have no power of annulling or even diminishing the action of the alkaloid within the body. Acids have no particular influence on the action of atropine. When administered by the stomach, the action of the drug is sometimes prolonged for two hours, and then develops suddenly.

Atropine passes undiminished and unchanged through the blood, and the kidneys are active in its elimination from the minute that it enters the circulation until it is entirely removed from the body. After a full medicinal dose, between two or three hours are required for this purpose. The presence of atropine in the renal secretion after taking the drug may be demonstrated by dropping one or two drops of the urine within the eyelids of another person or animal at intervals of 10 to 20 minutes for two or three hours and noticing its dilating action on the pupils. The atropine may be separated from the urine by shaking the latter with a quantity of chloroform equal to a sixth of its bulk, and separating the chloroform, or allowing it to evaporate spontaneously. The remaining stain is dissolved in a few drops of water, and a drop placed within the eyelids. The $^1/_{96}$ grain of atropine sulphate (sufficient to kill an infant) may thus be easily detected in the urine.

Atropine is a true diuretic and more powerful than any other that we possess, though in medicinal doses the diuretic effect is often masked by retention of urine. There is, after taking atropine, an increased elimination of all the solids (excepting generally the chlorine); the urea is always increased, often to a considerable extent, and, most of all, the phosphates and sulphates, which are sometimes doubled.

> Atropine diminishes the quantity of urine; it diminishes the total quantity and percentage quantity of urea; it increases relatively, and in many cases absolutely, the amount of nitrogen, other than that contained in urea. These effects cannot be attributed to the influence which the alkaloid exercises upon blood-pressure. How atropine acts to

produce an elevation of the bodily temperature has not been definitely determined. Thompson (Jour. of Phys., Dec., '93).

Sulphate of atropine was injected into the external jugular veins of rabbits first narcotized by chloral-hydrate, and the urine flowing from a cannula in the bladder measured every five minutes, registering the blood-pressure at the same time. The dose of the atropine salt used ($^1/_{12}$ grain) was large, but this quantity is well tolerated by rabbits; sometimes the dose was frequently repeated, and sometimes a still larger one was employed. In all but one the atropine was injected after I had raised the secretion of urine by the intravenous injection of urea, caffeine-sulphonic acid, or theobromine-sodium salicylate. The results of the experiments show that a diminution of the flow of urine usually follows the intravenous injection of atropine, independently of the blood-pressure, which is often raised. A series of experiments made with different strengths and quantities of urea solutions seem to show that the kidneys are not injured even when large quantities of urea are injected. Albumin was only occasionally met with after the injection of urea, and then in mere traces, though small quantities of sugar were found when an increased urinary flow had been produced by large quantities of urea. Walti (Archiv f. exper. Path. und Phar., B. 36, H. 5, 6, '95).

Atropine decreases the amount of urine, apparently by virtue of a paralyzing action on the terminations of the vagus. Lazaro and Pitini (Archivo di Farm. e Ter., v; Deutsche med.-Zeit., Feb. 3, '98).

Case in which patient took 15 to 20 drops of an atropine solution which had been ordered for him for a conjunctivitis. When examined he showed sugar in his urine. After this had disappeared it was found that 100 grammes of grape-sugar would readily produce an alimentary glycosuria, and that, therefore, he was a ready subject of alimentary glycosuria. The administration of large doses of atropine to guinea-pigs produced in four or five attempts the appearance of glycosuria. In some of these cases grape-sugar was given to them at the same time. In some, it was, therefore, an alimentary glycosuria; in others it appeared spontaneously when no grape-sugar was given, and was evidently due to the atropine. (Deut. med. Woch., July 13, '99).

The action of atropine on the sympathetic nervous system and the circulation is that of a direct and powerful stimulant. During the operation of medicinal doses the heart contracts with increasing vigor, the arteries increase in tone and volume, the capillary system is also stimulated, and a diffused warmth is felt throughout the body. If the dose be excessive, overstimulation is produced and signs of exhaustion are soon manifest. The maximum stimulant effect follows the use of moderate doses only, generally $^1/_{96}$ grain, not more than $^1/_{48}$ grain.

Several experiments made prove that the rise of temperature is not spinal, as heretofore held by me. The results obtained with the ingestion of atropine, after various operations, such as section in front of the pons Varolii and of the medulla oblongata, were so similar to those obtained after the same operations without atropine that I find it difficult to speak accurately as to the cerebral centre affected. The slight rise of temperature observed in the rabbit after puncturing the medulla oblongata or pons Varolii has not led me to believe in the existence, in these bodies, of thermogenic centres. I therefore conclude that, until the existence of heat-centres in the medulla and pons has been accurately determined, it is useless to assume that atropine acts upon them. Ott (Jour. of Nerv. and Mental Dis., Nov., '93).

The skin becomes the seat of a sensation of warmth followed by a temporary blush, and in children and adults of light complexion is sometimes followed by a scarlet suffusion, described by some as a "scarlatinous rash." In persons

subject to vascular irritation of the skin the redness remains and its disappearance may be attended with slight roughness and desquamation. Harley states that the general effect of atropine on the circulation predisposes to sweating; but Ringer, Bartholow, and others ascribe to atropine a strong inhibitory action over the sweat-glands. Certain it is, however, that atropine inhibits the secretory function of the mammary and salivary glands.

As regards the function of the liver, Harley believes atropine to be a cholagogue. By the action of atropine upon the unstriped muscular fibres, intestinal peristalsis is intensified.

> Atropine, in doses of $^{1}/_{4}$ grain, is able to instantly kill the leucocytes contained in $3\,^{1}/_{3}$ ounces of human blood, and in quantities of $^{1}/_{3}$ grain the leucocytes contained in $3\,^{1}/_{3}$ ounces of human blood live but a few hours. On the other hand, the leucocytes contained in $3\,^{1}/_{3}$ ounces of blood of the rabbit were not affected by a dose of $^{1}/_{3}$ grain of atropine. Maurel (Bull. Gén. de Thér., Apr. 15, '92).
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> While acting as a depressant to the hepatic function, atropine causes no change in the amount of iron in the liver, and only a slight diminution in the quantity of glycogen. Brunton and Delépine (Proceedings of the Royal Society, No. 234, '94).

Dilatation of the pupil is a prominent effect of atropine, however introduced into the system, accompanied by temporary paralysis of the muscle of accommodation.

> Methyl atropine in the form of a 1 per cent. solution of the hydrobromate, induces in emmetropic eyes a dilatation of the pupil, maximal in thirty to forty-five minutes. It diminishes in twelve hours and vanishes during the second day. Its disappearance can be accelerated by instillation of an eserine collyrium. The writer prefers to use it in the formula of 0.05 gramme methyl atropine hydrobromate with 0.1 gramme of cocaine hydrochlorate in 10 grammes of distilled water. One drop induces the maximal dilatation in from thirty-five to fifty minutes, with brief paresis of accommodation, not noticeable in myopia and emmetropia. The methyl atropine is free from the drawbacks of atropine, and is especially indicated for the diagnosis of incipient iritis when glaucoma is feared, also for the accurate determination of the static refraction, and for all cases in which dilatation of the pupil is required for ophthalmoscopic examination. Darier (Bull. de l'Acad. de Méd. de Paris, May 5, 1903).

In its action on the cerebro-spinal system the general effects of atropine resemble those of opium in that it is both an excitant and hypnotic, but the soporific effect is less marked; and coma, if it occurs, must be considered a remote consequence rather than a direct effect of the action of the drug. After large doses insomnia and delirium arise and poisonous doses prolong these effects for hours, and coma gradually supervenes. Headache, vertigo, illusions, hallucinations, a busy delirium, and sometimes somnolence are produced by large doses. More or less anæsthesia of the sensory centres of the cerebrum. The action on the motor centres and the spinal cord is comparatively slight. The corpora striata participate both in the hypnotic and in the excitant effects. Giddiness and muscular weakness, from inability for exertion, accompany the hypnotic effect, while restlessness and insomnia occur when the hypnosis is overruled by the excitant action. The spinal cord is least of all affected by atropine.

Atropine Poisoning. — Fatalities from atropine are comparatively rare, for the lethal effect comes on very slowly, and generally gives time both for appropriate treatment and for its elimination through

the natural channels. One-half grain of atropine has proved fatal, though Harley reports recovery after the ingestion of $1\,^1/_2$ grains.

The symptoms of poisoning are, in general, those following the use of a large dose (previously described), but more intensified. The action of the heart, however, while increased in frequency, is diminished in force; the arterial tension becomes subnormal; the pulse weak and its rhythm disturbed. As the vascular pressure falls, the skin cools, its color fades, and it becomes covered with clammy sweat. The delirium, at first mild and happy, becomes unpleasant or disagreeable, or may take the character of the delirium of terror, resembling the maniacal type. The respiration becomes feeble, superficial, rapid, and irregular. Disturbance of the respiratory functions and the impaired action of the heart and blood-vessels cause passive congestion of the lungs and brain. The urine, previously increased in amount, is diminished or even suppressed from lessened vascular pressure. Post-mortem examination reveals a distension of the right heart and congestion of the brain, lungs, and abdominal viscera.

More deaths have followed medicinal doses of atropine than of any other drug; if possible, therefore, other drugs should be substituted for it. Atropine has been used in the following diseases: 1. Neuralgia and other painful affections. Considering the large number of analgesics available, it should be used in the present day in exceptional cases only,—for example, in angina pectoris. 2. Whooping-cough and asthma. If the cases are severe and have resisted all other treatment, atropine may be tried. 3. The same applies to epilepsy. 4. It is very doubtful whether it is of any use in hysteria, paralysis agitans, and other tremors. 5. Chronic constipation. As there are plenty of substitutes, its use should be discontinued. 6. Lead colic. In this disorder the subcutaneous use of atropine has more disadvantages than advantages. 7. Nocturnal enuresis. Great caution is necessary, since large doses are required, as a rule. 8. As a cardiac tonic, and in those cases of permanent bradycardia which often end in epilepsy, atropine has been tried without much success in the latter cases, possibly because a slow pulse does not always correspond to a slowly acting heart. According to Dehio, it may benefit slight cases of cardiac irregularity, but is without effect in severe ones. 9. In night-sweats it acts well; but, although small doses tend to prevent collapse,—which is common in phthisical patients,—larger ones increase the liability to it. To begin with a dose of $^1/_{200}$ grain is unjustifiable in advanced cases of phthisis. 10. In chronic hypersecretion of HCl by the gastric mucosa several observers have found that atropine diminished the secretion, but others deny this. However, considering the bad effects of this hypersecretion on the gastric mucosa, in the present state of our knowledge atropine must still be tried. 11. Some observers state that atropine, given hypodermically, arrests hæmorrhage (hæmoptysis, etc.) by its action on the arterioles. 12. The injection of atropine before the administration of chloroform to prevent syncope has been given up by surgeons. 13. It has been recommended as an antidote to barium salts, hydrocyanic acid, nicotine, pilocarpine, and muscarine poisoning. 14. The question of its use as an antidote to opium will be studied in a further communication. Lépine (Sem. Méd., Nov. 25, '96; Brit. Med. Jour., Jan. 9, '97).

Case in which delirium was caused by ocular instillations in a girl of 5 years. She was restless, not sleeping at night; so evidently the first instillation of atropine affected her. During the period of poisoning there was no fever and no rash; delirium seemed to be the only symptom. A peculiar feature of the case was that after 6 drops of the atropine solution in each eye full dilatation of the pupils did not occur. A chemist who analyzed the solution

pronounced the drug atropine. S. Edith Ives (Amer. Med., Apr. 4, 1903).

Treatment of Atropine Poisoning. — If seen early enough, emetics or warm drinks should be administered, followed by the use of the stomach-tube. Tannin and charcoal may be used if a stomach-tube is not at hand and absorption has not taken place. Among the antidotes advised are coffee, alcohol, pilocarpine ($^1/_8$ to $^1/_4$ grain), muscarine nitrate ($^1/_{30}$ to $^1/_{15}$ grain), morphine sulphate ($^1/_8$ to $^1/_2$ grain), or eserine ($^1/_{200}$ to $^1/_{60}$ grain). The violent action of the drug should be restrained by the use of the foregoing antidotes given by hypodermic injection, in moderate doses, and repeated at intervals, as indicated by the condition of the patient and the urgency of the symptoms.

The antagonism between atropine and morphine is not as pronounced as some investigators claim. Binz in cases of opium-poisoning gives $^1/_6$ to $^1/_{10}$ grain of atropine, while Kobert recommends $^1/_{60}$ grain every half-hour. These doses are far too great and a single dose of only $^1/_{45}$ grain should be given. E. F. Bashford (Archives Inter. de Pharm. et de Therap., vol. viii, p. 311, 1901).

There can be no doubt that atropine may be of value as an antidote in morphine poisoning, but only before the third stage, and then only when given in small or moderate doses. But even here its usefulness is practically limited to a possible excitation of the respiratory movements and a stimulation of the circulation, both of which, however, may be fully compensated for in its pernicious effects, chiefly upon general metabolism. Given in large doses during the second stage, or in moderate to large doses during the third stage, it almost, if not without exception, does harm by intensifying the morphine condition, prolonging or shortening, but intensifying, the second stage, or shortening the third stage, and hastening the fatal issue. If the second stage is shortened, it is owed to the earlier development of the third stage of the poisoning. This has been personally found to be a uniform result of a large number of experiments upon dogs, and which is fully supported by the records of other investigators. In fact, a dose of morphine that is not lethal may be made so by the synergistic actions of a sublethal dose of atropine. E. T. Reichert (Ther. Monthly, May, 1901).

Therapeutics. — DISORDERS OF THE EYE.—Atropine is greatly employed in ophthalmological work, not only as a therapeutic agent, but largely in diagnosis, as it dilates the pupil, diminishes intra-ocular pressure, contracts the arterioles, and acts topically on the sentient nerves. Atropine is used when we wish to suspend the power of accommodation in cases of myopia or hypermetropia to determine the exact error of refraction, and in astigmatism to ascertain the difference in the meridians. In the examination of cataract (especially in its early stages) the use of atropine is of great value. A wider and better view of the fundus of the eye is also obtained through the pupil dilated by atropine. As a therapeutic means, atropine is invaluable in all superficial inflammatory conditions of the eye in which pain, tenderness, and photophobia are present. Mild solutions (1 or 2 grains to 1 ounce) instilled within the eyelids generally give prompt relief. In strumous corneal ulcers and phlyctenular keratitis (by diminishing photophobia and blepharospasm and lessening blood-supply) a few drops of a mild solution (1 grain to 1 ounce) two or three times daily will give relief. In syphilitic iritis where posterior or anterior synechiæ are a frequent complication, early and constant dilatation of the pupil should be secured through the use of solutions of atropine (2 to 4 grains to 1 ounce). Atropine will relieve the photophobia of acute

conjunctivitis and also that of chronic conjunctivitis associated with blepharitis and granular lids, if used in mild solution and not too frequently applied.

In the treatment of iritis the action of atropine is often augmented by the use of the Turkish bath. Claiborne (N. C. Med. Jour., '92).

In penetrating wounds of ciliary region and lens, even where light-perception is gone and where usually enucleation is performed, removal of lens will often be followed by recovery of comparatively useful vision; operation to be performed during first week of injury. Irritating solutions to be avoided. After-treatment: atropine, 1 per cent., every four hours, and compress bandage. Randolph (N. Y. Med. Jour., Feb. 23, '95).

The inflammatory conditions necessitating the use of atropine are confined to the eye itself; it is not indicated in inflammations of the appendages. Scleritis and episcleritis will generally yield to appropriate treatment, without mydriasis, also. In keratitis, atropine is indicated because it paralyzes accommodation, thereby relieving the cornea from any action the ciliary muscles may indirectly have on it, and because it acts as an anæsthetic to a limited degree. I have never seen glaucomatous symptoms arise from the use of atropine in keratitis, but conjunctival irritation in this connection is not uncommon.

In iritis atropine is indicated at once, and the sooner the iris is brought fully under its influence, the better; and especially is this true of the plastic variety. In serous iritis, without plastic exudation, mydriatics act by dilating the iris, thereby relieving pain. In the plastic variety, not only is this the case, but they also overcome the danger, if used in the onset of the disease, of adhesions being formed between the iris and the anterior capsule of the lens, constituting what is know as posterior synechia. In inflammation of the ciliary body, cyclitis, atropine is indicated as an antiphlogistic and analgesic. In inflammations of the deeper structures of the eye, as in hyalitis, retinitis, choroiditis, and even hæmorrhage, I believe atropine has a place. There is a difference of opinion here, some holding that the enlargement of the pupil from atropine allows more light to enter the eye than is good for the inflamed structures, which is a fact; but the paralyzing of the accommodation, it seems to me, is beneficial, especially when one can exclude the light by means of very dark glasses. The greatest fear to be entertained from the use of atropine—and, in fact, of all mydriatics—is increase of tension; but this should be a desirable aid in case of hæmorrhage from the retinal vessels. In simple optic neuritis atropine is not beneficial.

The contra-indications for the use of atropine can be inferred from what I have already said, but the greatest fear, and one which even the most experienced feels, is the possibility of precipitating an attack of acute glaucoma. Van Fleet (Med. News, Feb. 5, '96).

Clinical study of action of mydriatics and myotics on 12 cases of total oculomotor palsy shows that atropine widened the pupil an additional 1 millimetre to $1\,^1/_2$ millimetres, which is attributed to the action of the mydriatic on nerve-ends and fibres that were not completely paralyzed, rather than to its influence on the sympathetic nerve. Sprio (Centralb. f. prakt. Augenh., Mar., '98).

Atropine should not be used in conjunctival troubles, in glaucoma or increased intra-ocular tension, or as a mydriatic in patients over forty. It is indicated in iritis, keratitis, and corneal ulcer and may be used diagnostically to dilate the pupil and to relax accommodations in persons under thirty or thirty-five years. Marple (Phila. Poly.; Post-grad., May, '98).

In ocular therapeutics the greatest indication is in iritis, whether rheumatic, traumatic, syphilitic, or idiopathic. In adults 1 drop of a 1-per-cent. solution usually suffices to dilate the pupil fully if instilled every two or three hours. In children of one to five years, $^1/_4$-of-1-per-cent. solution should be used. Intolerance of the drug is shown by: (1) toxic symptoms, as dry throat, nausea; (2) the production of catarrh [this usually follows long-continued use]; (3) redness and swelling of the lids. It is indicated

in all traumatisms of the eye when iritic or cyclitic involvement is suspected, in corneal inflammations, ulcer of the cornea, and to dilate the pupil for ophthalmoscopic examination. Among the abuses cited are its uselessness or even positively injurious effects in simple uncomplicated conjunctivitis, not only because it possibly may increase the conjunctival inflammation, but because of the unnecessary inconvenience of disturbed vision. It should never be used simply to dilate the pupil temporarily in patients beyond forty-five years of age, the glaucomatous tendency being more marked at this time, and its instillation can readily so occlude Fontana's spaces as to precipitate an attack of acute glaucoma. Under no circumstances should it be used in glaucoma. A. D. McConachie (Maryland Med. Jour., No. 13, p. 195, '99).

Neuralgia. — Atropine gives very satisfactory results in neuralgia, especially in neuralgia of the trigeminus, and in sciatica. In the former, a solution of the drug may be applied externally over the painful area or instilled within the eyelids, or injected, not subcutaneously, but deeply, into the tissues in the neighborhood of the affected nerve-trunk. In sciatica the last method is the best. The largest dose compatible with the safety of the patient must be used (generally $^1/_{50}$ to $^1/_{30}$ grain), and decided curative results may be expected (Bartholow). In traumatic neuralgias Weir Mitchell asserts that atropine is useless. Earache, when neuralgic in character and not produced by pressure of pus against the tympanum, may be relieved by instilling a few drops of a solution of atropine, previously warmed. Periuterine and dysmenorrhœal neuralgias are relieved by deep hypodermic injections of atropine in solution. Muscular cramp from injuries to the nerve-trunk are often relieved by atropine, injected into the substance of the affected muscle. Hepatic, intestinal, uterine, and renal colic may be relieved by hypodermic injections of atropine, but the best results are reached when morphine and atropine are combined. Vaginismus has been relieved by the topical use of pledgets of lint wet with a mild solution of atropine.

Insomnia.—The insomnia of mental disorders and of delirium tremens may be overcome by the hypodermic injection of atropine when the following indications for its use are present: Coma vigil, great restlessness, weak heart, cold surface, cyanosis, clammy sweat. When there is a condition of hyperæmia of the cerebro-spinal centres (excitement with elevated pulse-rate and increased arterial tension) atropine can only do harm. (Bartholow.)

Asthma.—Atropine in doses of $^1/_{120}$ to $^1/_{60}$ grain, given hypodermically, will relieve the paroxysms of asthma, especially if given at the beginning of the paroxysm. Here the effect is systemic and the injection need not be made over the pneumogastric.

Cutaneous Disorders.—Atropine in solution (4 grains to 1 ounce) may be applied externally in all painful and congested conditions of the skin. Erythematous dermatitis, erysipelas simplex, pruritus of the vulva, and fissure, etc., may be relieved in this way. The pain of cancerous infiltrations of the skin may be relieved by painting the surface with an atropine solution and, when the skin has become disintegrated through sloughing, lint dipped in a weak solution of atropine and applied to the surface gives relief.

The troublesome pruritus of icteric and diabetic patients is best dealt with by calmative applications, as a flannel compress saturated with a solution of atropine, 1 to 500, covered with a sheet of

oiled silk. Besnier (Bull. de la Soc. de Méd. d'Anvers, May, '91).

Mammary Congestion. — When the glands are swelled or tender, either early in lactation or later, when we wish lactation to cease (on death or removal of infant or weaning), atropine (4 grains to 1 ounce of rose-water) is a clean and efficient remedy to apply to the glands. The gland is first cleaned with soap and warm water, carefully dried, and the solution of atropine applied to the surface (avoiding the nipple and the areola) with a camel's-hair brush and allowed to dry. The glands should then be drawn upward and inward (to take off weight and tension) and retained by means of a proper bandage. If preferred, the breast may be enveloped in lint wetted with the above solution. If the pupils dilate and the mouth becomes dry, the application should be removed.

Excessive Diaphoresis.—The night-sweats of phthisis may be checked by the subcutaneous injection of atropine; $^1/_{60}$ grain at bed-time usually suffices (Bartholow). The copious perspiration induced by drugs, such as pilocarpine, opium, alcohol, and other diaphoretics, may be checked by the use of atropine.

Collapse.—Since atropine stimulates the heart and increases the blood-pressure, we find it useful in moderate doses in the collapse of fevers, cholera, sunstroke, and cardiac syncope. The dangerous exhaustion consequent upon colliquative diarrhœa and internal hæmorrhage indicate the use of atropine. It is also valuable for the prevention of shock after operative procedures and anæsthesia.

Atropine—$^1/_{75}$ to $^1/_{100}$ grain given before the administration of ether—reduces the chances of shock. Case of a woman, who, in a preliminary examination, came out of the influence of ether in a deplorable state; three days later, however, when the operation was about to be performed, atropine was given, and she was taken from the table with as good a pulse as before anæsthesia. Lewis A. Stimson (N. Y. Med. Jour., Mar. 9, '89).

The combination of atropine and morphine prior to ether inhalation, injected hypodermically, checks the after-vomiting and is preferable to bromides, chloral, and opium, all of which often fail to produce good results. Rushmore (Jour. Amer. Med. Assoc., Mar. 19, '93).

Atropine by promoting contraction of the arteries antagonizes the dangerous fall of blood-pressure produced by chloroform. It may be used by intravascular, hypodermic, or intravenous injection. Schäfer (Lancet, Feb. 5, '98).

Excessive Vomiting.—Atropine used hypodermically has been found useful in some cases of seasickness and in the vomiting of pregnancy.

Atropine is also available in a variety of other diseases, judging from the evidence adduced.

Cholera Infantum. — Beneficial effects have been obtained by Larrabee by means of hypodermic injections of $^1/_{50}$ grain of atropine followed by calomel and lime-water containing a little carbolic acid. Nothing but toast-water was allowed for thirty-six hours.

William Bailey, of Louisville, has found that infants bore atropine well, and gave almost adult doses of atropine to children only a few months old, combining the drug with relatively very small doses of morphine: for instance, $^1/_{80}$ grain of morphine and $^1/_{150}$ grain of atropine, repeated two, three, or four times in twenty-four hours, making the adult dose of atropine. This controls —he states—the phenomena of cholera infantum, which would terminate life perhaps in a few hours without such treatment.

Lauder Brunton observed a case in which a child was collapsed and appar-

ently dying. A subcutaneous injection of atropine revived her for a time. This was followed by relapse; but another injection was administered, with good results, and she recovered.

INFLUENZA. — For the delirium of inanition and allied states, when found as sequelæ of influenza, Sachs found that there was nothing better than subcutaneous injections of atropine and morphine.

HÆMORRHAGIC DISORDERS.—Atropine has been highly recommended in many disorders characterized by an undue flow of blood.

> In two cases of metrorrhagia this drug acted well as an hæmostatic. One was of a fortnight's standing and had been treated by ergot internally and tampons in vagina; the bleeding completely ceased after four injections—each of $^1/_{200}$ grain of atropine—used twice daily. The other, a most severe case, had been persistently treated by hydrastis Canadensis and ergot internally and ice locally, without avail. Marked improvement followed half an hour after the first hypodermic injection of atropine; the bleeding had notably lessened soon after the second injection, given five hours later, and completely ceased after the third, given twelve hours after the first. Dimitrieff (Revue Scien. et Adminis. des Méd. des Armeés de Terre et de Mer, No. 50, '91; Brit. Med. Jour., May 21, '92).
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> Four cases of uterine hæmorrhage of alarming character, wherein all other methods failed, were controlled by atropine employed hypodermically: $^1/_{60}$ grain repeated in three hours, and a third given twelve hours later. Dimitrieff reports two cases treated in this way with good results. Strizdred (Univ. Med. Mag., Sept., '92).
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> Five cases of uterine hæmorrhages in which atropine sulphate was used with very gratifying results, when the usual remedies failed. Two cases were postpartum, three were simple menorrhagia, and the last from uterine cancer. The dose administered was $^1/_{200}$ grain every two hours, per mouth. W. G. Johnson (Penna. Med. Jour., Feb., '98).

MORPHINISM. — Kochs, of Bonn, employed subcutaneous injections of atropine as an antidote to morphinism in five cases, diminishing the unpleasant results of abstinence. He says that $^1/_{300}$ grain of the sulphate should be given at first, patient being watched for several hours. A second dose may be given, if necessary. I cannot approve of this treatment. In most cases the quantity of the morphine should be slowly diminished, thus reducing the suffering to a minimum. (Norman Kerr.)

ANTIDOTAL USES.—In opium poisoning Harley advises the use of atropine, in doses sufficient to stimulate the circulation and respiration, whereby the secretion of urine is increased and the elimination of the poison hastened. For this purpose $^1/_{80}$ to $^1/_{60}$ grain should be given hypodermically every hour or two, according to the gravity of the symptoms and the response of the nervous system to the remedy. The same remarks apply to the treatment of poisoning by calabar-bean (physostigmine—eserine), for which atropine is a more decided antidote.

> In three patients who had formerly suffered from tinnitus aurium due to quinine, the symptoms could, at least, be considerably diminished by adding atropine to the quinine. The amount of atropine prescribed amounted to $^1/_{120}$ grain daily. Aubert (La Méd. Mod., Mar. 24, '97).

INTERNAL USES.—The indications for the internal uses of atropine will be considered under the head of BELLADONNA.

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B

BARIUM. — Barium is not employed medicinally, and is of no interest to physicians except as they may require its aid for purposes of chemical research. So, too, of the fifty salts of the metal, but two—the chloride and sulphocarbolate have ever been employed therapeutically, and even then only in a desultory and incomplete way. The dioxide and sulphide bear a quasirelation to medicine, however, but in a chemical rather than a therapeutic sense, the former being employed in the manufacture of hydrogen dioxide, while the latter finds use, when mixed with starch (1 to 3) and water to the consistency of cream, as a depilatory.

Barium chloride is a white, crystalline substance possessed of a bitter, disagreeable taste. It is readily soluble in water, fairly so in alcohol, and but scarcely at all in absolute alcohol.

Preparations and Dose.—Barium chloride, $^1/_2$ to 2 grains.

Barium sulphocarbolate, $^1/_4$ to 1 grain.

Physiological Action.—A recent work on therapeutics is responsible for the statement that barium chloride in its action upon the circulation resembles both ergot and digitalis: a conclusion that would seem, physiologically speaking, self-contradictory. Hypodermic injections of the chloride of barium, in doses of $^1/_{12}$ grain per pound of the body-weight, produce death in dogs in twenty-four hours after the administration of the drug. With smaller amounts death is more retarded, but the toxic phenomena produced in the meantime are vomiting, diarrhœa, albuminuria with hæmaturia, and convulsions preceding the fatal termination. The most prominent post-mortem lesion found is nephritis with congestion of the glomerules, hæmorrhages in the tubes, and lesions in the cells of the labyrinth. These lesions are different from those caused by mercury; they consist of a granulo-fatty infiltration of the secretory epithelium of Heidenhain. Traces of hæmoglobin are found in the cells, this hæmoglobin soon passing into the secreting cells and afterward into the urine. These histological changes explain the phenomena observed during life: albuminuria and hæmoglobinuria. (Pilliet and Malbec.)

Barium chloride exerts its chief influence on the heart and resembles very closely in its effects those of digitalis. In the frog small doses increase the action of the heart-muscle, and large doses arrest this viscus in systole. The interesting fact was discovered that a heart arrested by muscarine or chloral was started again by using this salt, and it was also found that the strongest electrical stimulation of the vagi failed to relax the systolic spasm. Furthermore, it was proved that this loss of inhibitory control was not due to a depression of these nerves, but to the direct cardiac effects. In warm-blooded animals the drug slows the heart solely by its action on this viscus, but if very large doses are given there is a primary acceleration of the pulse, probably due to stimulation of the accelerator nerves. Finally, this is replaced by slowing caused by direct depression of the heart-muscle. Barium also increases to a marked extent arterial pressure, and, like pilocarpine, increases the secretion of saliva. (Bary.)

The foregoing is also borne out by studies made by Ringer and Sainsbury.

The physiological action of the sulphocarbolate has not been investigated.

Therapeutics. — Barium chloride has

been tried externally in a multitude of maladies, but in such a way that it is hardly safe to attempt to deduce conclusions of a definite character therefrom. Even in the latter part of the last century an ointment of this salt was suggested as a remedy for scrofulous tumors; later it was tried—as have been most salts—as an application to goitrous swellings; recently Kobert, of Dorpat, attempted to relieve dilated cutaneous veins by application of a solution incorporated with lanolin, "but without result." Strange to say, a late work on materia medica and therapeutics gives Kobert's evidence as favorable instead of unfavorable, the error arising probably from the fact that Bartholow rendered a report opposed to that of the Russian observer.

Internally the medicament appears, when given in minute dose, to be both alterative and stimulant. It has been employed in a variety of diseases, and is, by no means, new, since as early as 1789 Crawford recommended it to be administered to scrofulous patients and applied as an ointment to scrofulous swellings of the neck; half a century later Walsh suggested it as a substitute for iodine in like cases. Cases of the cure of aneurism by this salt have been reported in current medical literature.

Da Costa holds that in valvular disease of the heart it is both a general and cardiac tonic, "diminishing and relieving cardiac distress, increasing the tone of the blood-vessels, and producing diuresis; also that it is a remedy that can be taken for a long time without danger or disordering the stomach." This is denied, however, by Bardet, who also chronicles a death after ten days' use of the drug, in which but $^1/_4$ grain was ingested daily—total, $2\,^1/_2$ grains. This would indicate necessity for the greatest caution when administered internally.

Several writers have also lauded barium chloride in functional heart maladies, but the evidence adduced is inconclusive. Brown-Séquard tried it in epilepsy with negative results; but it appeared to him to be of value in tetanus and paralysis agitans. Another author recommends it in diffuse and multiple cerebral sclerosis, but without even a suggestion as to the *rationale* thereof.

Barium sulphocarbolate, like most sulphocarbolate salts, has been employed in the colliquative diarrhœas of children, especially those suffering from rachitis, and in gastro-intestinal disturbances, but it is impossible, as yet, to draw conclusions from the few incomplete reports that have been rendered.

> The use of barium chloride recommended for the milder degrees of cardiac insufficiency, especially in the disturbances of compensation which are accompanied by a loss in the arterial blood-pressure. The pulse and blood-pressure are favorably influenced also in pneumonia. It seems to act by contracting the blood-vessels and by slowing the pulse through the irritation of the pneumogastric nerve thus evoked. It is well borne and seems to have no disagreeable after-effects, but it cannot replace digitalis. Tabara (Deutsche med. Wochen., Sept. 24, 1903).

BARLOW'S DISEASE. See SCORBUTUS, INFANTILE.

BELLADONNA.—Belladonna (deadly-nightshade) is a solanaceous plant, botanically known as *Atropa belladonna*, Linné. It is indigenous to southern Europe and central Asia. Two parts of the plant are used in medicine: the leaves and root. The preparations are extract (solid) and tincture of the leaves, and fluid extract of the root. Bella-

donna plaster and belladonna ointment are made from the extract of the leaves, but belladonna liniment is made with fluid extract of root. The active principle is the alkaloid atropine, which occurs in the plant in combination with malic acid as bimalate. Another principle, analogous to atropine and possessed of mydriatic properties, is obtained from the mother-liquor, after atropine has crystallized out, which is called "belladonnine," the latter being an amorphous, brown, varnish-like mass, freely soluble in chloroform and slightly soluble in water. Atropine is used in all cases where is desired an immediate and rapid action, as when a patient cannot swallow, and when the stomach will not tolerate belladonna or its preparation. Belladonna and its preparations are preferred when a slow and more continuous action is desired.

Dose and Physiological Action.—The dose of belladonnæ foliorum is 1 to 5 grains. Of belladonnæ radix from 1 to 3 grains may be given. The extractum belladonnæ foliorum is given in doses of $^1/_{10}$ to $^3/_4$ grain. The dose of extractum belladonnæ radicis fluidum is from 1 to 3 minims, and of the tinctura belladonnæ foliorum is from 5 to 15 minims. The physiological action of belladonna has been already described in the article on ATROPINE.

Belladonna Poisoning. — The symptoms of poisoning by belladonna appear usually within two hours, and are similar to the poisonous effects of all the solanaceous plants (stramonium, or thorn-apple; Jamestown weed; hyoscyamus, or henbane; *Solanum dulcamara,* or bitter-sweet; woody-nightshade, etc.). The characteristic effects, stated briefly (fuller description has already been given in article on ATROPINE), are frequently flushed face, redness of the skin, heat and dryness in the throat, dilatation of the pupil, sensory illusions, and active delirium. Death, when it occurs, usually takes place within twenty-four hours. A few berries of belladonna and one drachm of the extract have proved fatal. The post-mortem appearances are not constant or well marked. The pupils are dilated. The brain may be congested and the stomach inflamed. The remains of the leaves or berries should be searched for in the stomach and intestines.

Effect of belladonna upon the human vision was considered in a libel suit recently reviewed by Appellate Division of the Supreme Court at Albany, New York. The plaintiff was a physician who treated the defendant's daughter for some ailment of the eyes, and in the course of the treatment administered belladonna. The girl subsequently became blind, and her father attributed the loss of her eyesight to the unskillfulness of the plaintiff and his ignorance in giving her belladonna and thus producing her blindness. The doctor sued him for libel for publishing statements of this purport. Every medical witness testified that belladonna would not, and, indeed, could not, cause blindness in any person. They all agreed that the drug produced a dilatation of the pupil, accompanied by a partial loss of vision, but that this was only temporary and the effect would gradually pass away. Proof on this point was so clear and conclusive as to leave no doubt in the mind of the Appellate Court that the unhappy father was mistaken in holding the doctor responsible for the misfortune of his child. Editorial (Med. Standard, May, '98).

Case of belladonna poisoning after the administration of a 2-grain belladonna pessary in a woman aged 62 years. In attempting to administer some medicine with a spoon she started violently at the moment the spoon touched her lips. The approach of a candle in order to study the reaction of the pupils gave the same result. Her face was much congested. There was no stertor. This condition

continued for almost twelve hours, after which she awakened with a slight headache, but without any recollection of what had transpired. Reuell Atkinson (Brit. Med. Jour., Feb. 25, '99).

Case in which there occurred symptoms of belladonna poisoning after the application, to the back, of an ordinary perforated belladonna plaster. Prior to its application the skin had been freely rubbed with a towel. H. Aldersmith (Brit. Med. Jour., May 27, '99).

Treatment of Belladonna Poisoning.—The treatment of poisoning by belladonna is the same as that outlined for atropine poisoning: Evacuation of the stomach by emetics or stomach-pump. Morphine ($^1/_8$ to $^1/_2$ grain) should be given hypodermically, repeated at intervals according to the urgency of the symptoms and the response to the remedy. Pilocarpine ($^1/_8$ to $^1/_4$ grain) or eserine ($^1/_{200}$ to $^1/_{60}$ grain) may be used in the same manner. When the patient shows signs of improvement, castor-oil may be given to evacuate the bowels and remove any remaining particles of the poisonous leaves, berries, or root. Strong coffee and alcohol are useful agents if the patient is conscious and can swallow.

Case of a woman confined three or four days before. Found a slight rash all over the body, which had the appearance of measles, and somewhat crescentic in character; temperature a little over 101°. On inquiry learned an ointment containing extract of belladonna was being used on breasts with a view to getting rid of her milk. It was a belladonna rash. Have seen several cases of belladonna poisoning from the local application of belladonna liniment. Campbell (Montreal Med. Jour., Dec., '96).

Case of a man, aged 45, who took, on an empty stomach at 5.30 A.M., a little over an ounce of glycerinum belladonnæ: the equivalent of about 3 grains of atropine. Treated by apomorphine, strychnine, and morphine subcutaneously. Recovery occurred after twenty-four hours. There was no maniacal excitement, but delirium and coma; the first prominent symptom was muscular inco-ordination. The experiments of the Edinburgh committee go to show that morphine is not antagonistic to atropine, although atropine is to morphine; but one or two cases are on record where morphine by subcutaneous injection relieved the symptoms of atropine poisoning. One case is specially mentioned by Binz where a boy had eaten the seeds of *Datura stramonium*, the alkaloid of which is in many respects identical with atropine. In this case death seemed inevitable, and as a last resource morphine was administered, with the result that the grave symptoms were arrested, and the boy speedily recovered. In the case just recorded there seemed to be undoubtedly great benefit derived from morphine, as the delirium and hallucinations subsided almost immediately, and remained permanently in abeyance. Duncan (Brit. Med. Jour., May 8, '97).

Therapeutics. — GASTRO-INTESTINAL DISORDERS.—Mercurial ptyalism and the ptyalism of pregnancy may be relieved by the tincture of belladonna given in doses of 5 to 10 drops every four to six hours. Gastralgia and the pain of gastric ulcer are relieved by atropine. Bartholow suggests the following:—

℞ Atropine sulph., $^1/_5$ grain.
Zinc sulph., 30 grains.
Distilled water, 1 ounce.—M.

From 3 to 5 drops twice or thrice a day.

He recommends a similar combination as very effective in pyrosis, chronic gastric catarrh, and irritative dyspepsia. Vomiting of pregnancy may be relieved by the internal administration of $^1/_{120}$ grain of atropine sulphate, in water, before meals; if the stomach is irritable, the atropine may be given in suppository, or, dissolved in chloroform (1 to 96), it may be used on lint applied to the epigastrium. Habitual constipation

may be relieved by $^1/_6$ to $^1/_2$ grain of the extract in pill, taken at bed-time. (Trousseau.)

Added to other purgatives it diminishes their griping action, and, since it increases peristalsis and allays spasm, it increases their efficiency. When there exists a torpor of the lower bowel aloin is a valuable addition. An excellent combination is

℞ Aloin,
Ext. nux vomica,
Resin podophyllin, of each, $^1/_2$ grain.
Ext. belladonna, $^1/_4$ grain.

Make 2 pills. One or two at bed-time. Heart-burn and water-brash may be relieved by atropine ($^1/_{100}$ grain) combined with 5 drops of dilute muriatic acid, well diluted and taken before meals.

Fevers. — Belladonna has been used with good results in typhus and typhoid fevers. Graves suggested that the contracted pupil was an indication for its use. Bartholow advises it when there is much low, muttering delirium, subsultus, and stupor, but cautions against its use in the condition of delirium ferox. The tincture may be used in doses of from 5 to 10 drops every four hours.

Disorders of the Air-passages. — Acute coryza may be aborted through the use of the tincture of belladonna, 5 drops being given at first and 1 or 2 drops every succeeding hour, until the physiological effects are produced. In pharyngitis with increased secretion similar treatment is efficient; if there is much fever 1 drop of tincture of aconite with 2 drops of tincture of belladonna may be given every hour or two. Aphonia, due to fatigue of the vocal cords, may be removed very speedily by a morning and evening dose ($^1/_{120}$ to $^1/_{80}$ grain) of atropine; hysterical aphonia may, not infrequently, be quickly cured in the same way. (Bartholow.)

> I have long regarded the mucous expectoration in bronchitis, whether viscid and vitreous or profuse and watery, as rather an increased secretion than an inflammatory product, and this view is supported by the promptness with which tincture of belladonna, in 10-minim doses thrice daily or oftener, checks the secretion and relieves an incessant and troublesome cough. By this experience I have been led to administer belladonna in cases of bronchitis following ether inhalation, and, although my cases are few, yet the success has been sufficient, I think, to draw attention to this treatment, that others with more opportunities may test the efficacy of belladonna. I would also suggest that belladonna should be given to patients who, after aspiration, suffer from an abundant watery expectoration, so profuse sometimes as to kill by suffocation. Sydney Ringer (Brit. Med. Jour., Nov. 21, '96).

Spasmodic Disorders.—In pertussis belladonna may be considered one of the most reliable remedies. As Bartholow suggests, it is not adapted to all cases, but is most effective in the spasmodic stage and in those cases which are characterized by profuse bronchial secretion. He recommends an aqueous solution of atropine sulphate (1 to 480), giving 2 to 4 drops at a dose. The tincture of belladonna may be given in doses of from 3 to 5 minims every three or four hours, stopping when there is a perceptible dilatation of the pupils, or even slight reddening of the skin. The dryness of the throat and mouth may be relieved by small doses of the iodides, by small doses of wine of ipecac or antimonial wine, by occasional small doses of calomel, or by ammonium chloride. Westbrook suggests the following:—

℞ Tinct. belladonna, 3 to 5 minims.
Alum, 1 drachm.
Syrup of Tolu, 1 ounce.
Water, 2 ounces.—M.

Of this mixture the child may be given a teaspoonful every two or three hours, day and night, if it is awake. When the spasm is marked and very frequent, the following is used:—

℞ Tinct. belladonna, 3 minims.
Tinct. camphorated opium, 2 to 4 drachms.
Muriate of ammonium, 1 drachm.
Bromide of ammonium, 2 drachms.
Syrup of wild cherry-bark, enough to make 3 ounces.—M.

Of this a teaspoonful, diluted, is given every two or three hours, night and day, if the child is awake. Forchheimer advocates the use of quinine in conjunction with belladonna.

In pertussis, when a complication of measles, belladonna pushed to its physiological effects acts well. Bernardy (Annals of Gyn. and Pæd., July, '94).

Belladonna *per se* will relieve pertussis. The younger the child, the better the drug acts. It takes proportionately a larger dose to produce toxic symptoms in a child than in an adult. The drug is given every hour unless marked dilation of the pupils is produced. Garrison (Med. News, June 12, '97).

In asthma and in the dyspnœa which accompanies emphysema belladonna gives great relief. According to Bartholow's observations, when the bronchial secretion is deficient, the pulse much accelerated, and the skin dry and hot, belladonna adds to the distress; its good effects are noticed when the expectoration is abundant, the skin cool and moist, and the pulse quiet and of low tension. For the relief of the paroxysm the hypodermic administration of atropine, or of atropine and morphine combined, is to be preferred to medication by the stomach, as the latter is too slow. After the paroxysm is relieved, the effect may be prolonged by internal medication. Belladonna-leaves may be used by the method of fumigation. The leaves previously dipped in a saturated solution of nitre and then dried may be burned in a close apartment, or on a saucer, the fumes being inhaled from a paper funnel covering the same. Pastilles made of belladonna, stramonium, poppy, tobacco, etc., may be used. Trousseau gives a formula for asthmatic cigarettes:—

℞ Belladonna-leaves, 5 grains.
Stramonium-leaves,
Hyoscyamus-leaves, of each, 3 grains.
Extract of opium, $^1/_6$ grain.
Cherry-laurel water, a sufficient quantity.

The leaves are moistened with a solution of the opium in the cherry-laurel water, and when dry made into a cigarette. Two to four such cigarettes may be smoked daily.

A person liable to attacks of asthma should be classed with those who have fits of epilepsy and occasional attacks of sick headache. They have unstable nerve-centres, likely to explode their energies at any moment, and exhibit the pathological phenomena peculiar to nerve-storms. Treatment should be directed to break up this habit morbidly acquired by the nerve-centres, and by prolonged medication to maintain the centres in a state of more stable equilibrium. This is done very successfully in epilepsy, and can also be done in asthma. I give, for this purpose, chloral and belladonna night and morning, or, at least, at bed-time, and find that, after a time, the attacks diminish in frequency and lessen in severity. Pearse (Practitioner, Jan., '93).

Belladonna is useful in the treatment of spasmodic cough and in spasmodic croup, given between the paroxysms; more rapid measures are needed for the relief of the paroxysm itself.

In the treatment of nocturnal incontinence of urine, no single remedy has given such good and uniform results in suitable cases as belladonna. This distressing ailment may be caused by hyperacidity of the urine, relaxed condition of the sphincter vesicæ, or to an irritable condition of the vesical mucous membrane; belladonna gives prompt relief in the two last-named conditions. In male children phimosis, accompanied often by adhesion of the prepuce to the glans penis and retained smegma, is a frequent cause of incontinence; in these circumcision, and not belladonna, is indicated. Again, the presence of ascarides may be sufficient to cause nocturnal incontinence, especially in female infants and children; here again belladonna is of no avail. In suitable cases, as indicated above, atropine, in solution or in tablets, is best suited for internal administration. Beginning with a small dose, at bed-time, the dose is gradually increased until systemic effects are produced. It must be remembered that as regards children generally too little of the drug is given. After the relief or cure of incontinence the best results are obtained by continuing the use of the drug for several weeks, in diminishing doses, with an occasional intermission of one to three days, during which time it is not given. This advice holds good in treating spasmodic disorders generally.

In spasmodic conditions of the rectum associated with fissure, hæmorrhoids, cancer, chronic constipation, etc., a small suppository (6 to 10 grains), containing from $^1/_4$ to $^1/_2$ grain of the extract, introduced well up into the rectum beyond the internal sphincter, gives great relief.

In intestinal obstruction and strangulation I have known relief to follow elevation of the pelvis on a firm pillow so as to allow gravity to act toward the thorax; and with this treatment, combined with starvation, and the use of belladonna and opium, I have had cases of natural recovery. Belladonna may be used externally also with glycerin, and in suppository with gelatin. Thomas Bryant (Lancet, Jan. 17, '91).

In volvulus belladonna employed with opium in full doses until constitutional effects shown, for peristaltic paralysis due to tympanites or fæcal accumulation. May be combined with calomel. Sodium sulphate in hourly doses of 1 to 2 drachms. Lavage-tube for bowel-flushing. Stokes (N. Y. Med. Jour., No. 1778, '95).

In lead colic, whether due to direct excitation of the intestinal ganglia or of the abdominal fibres of the vagus, or to simple accumulation of hard and dry fæces in the intestine, from reflex action upon the contraction of smooth muscular fibres consecutive to primary irritation of the sensory nerves, belladonna or its alkaloid, by diminishing, more or less completely and in different degrees, the irritability of the peripheral nervous apparatus, takes away an indispensable factor whereby abnormal stimuli operate through the nerves in increasing the contractility of the smooth muscular fibres. Traversa (Il Policlinico, No. 24, '97).

In pelvic affections of women, attended by hyperæmia, pain, and spasm, a larger suppository (30 to 60 grains), containing from $^1/_2$ to 1 grain of the solid extract, may be introduced high up within the vagina and retained by means of a tampon of non-absorbent cotton, at night; in the morning a hot-water vaginal douche will add to the comfort and well-being of the patient.

In dysmenorrhœa, belladonna given with the advent of pain relieves by relaxing the spasms. Handfield-Jones (Brit. Med. Jour., May 27, '93).

Epilepsy. — Belladonna, according to Trousseau and Pidoux, is a more efficient remedy in the treatment of epilepsy than the salts of silver, copper,

or zinc. Both insist that belladonna should be given steadily for a year in gradually increasing doses, and that if amendment is then produced it should be continued through two, three, or even four years. The best results from the use of belladonna are obtained in nocturnal epilepsy, in *petit mal*, and in pale, delicate, and anæmic subjects, with cold hands and feet, blue skin, and weak heart (Bartholow). Nothnagel advises a combination of zinc oxide with the belladonna, the former in gradually increasing doses. Moeli has advised an alternation of atropine and bromides as very effective, on the analogy of the opium-bromide treatment. Belladonna is not equal to the bromides in diurnal epilepsy, in epilepsy accompanied by cerebral hyperæmia, or in epileptiform convulsions due to an organic lesion of the brain. More effectual than the atropine is Trousseau's method: During the first month the patient takes a pill—composed of extract of belladonna and powdered leaves of belladonna, of each, $^1/_5$ grain—every day, if his attacks occur chiefly in the day-time; or in the evening, if they are chiefly nocturnal. One pill is added to the dose every month; and, whatever be the dose, it is always taken at the same time of the day. The dose may thus be increased from 5 to 20 pills or more. If this treatment fails to cure, it yields much relief.

> Belladonna may, in grave cases of epilepsy, bring about a prolonged suspension of attacks analogous to that produced by bromides. Féré (Journal des Connaissances Méd. Prat. et de Pharm., Nov. 21, '95).

Cerebro-Spinal Disorders.—Belladonna and atropine have been found useful in the treatment of epidemic cerebro-spinal meningitis, the basilar meningitis of children, and the various acute forms of myelitis, etc. In cerebro-spinal meningitis, in which, so long as consciousness exists if there is great pain, the addition of opium or morphine to the belladonna or atropine increases its efficacy.

Neuralgia.—The ointment or plaster of belladonna is a useful application in neuralgia of various forms (mammary, intercostal, cervico-dorsal, etc.). A few drops of aconite used to moisten the surface of a belladonna plaster before applying will in most cases increase its efficiency. (See Atropine.)

Miscellaneous.—Belladonna has also been recommended in a variety of disorders other than the foregoing, prominent among which are cystitis, hysteria, migraine, and angina pectoris.

> In acute cystitis the first indication in treatment is to allay tenesmus and pain. The following suppository should be used every four hours:—
>
> ℞ Morphine muriate,
> Cocaine hydrochlorate, of each, $^1/_6$ grain.
> Extract of belladonna, $^1/_{12}$ grain.
> Cocoa-butter, 46 grains.
>
> In hysteria in children belladonna, in doses of $^1/_8$ grain of the extract, is useful, especially for the visceral pains. Simon (Med. and Surg. Reporter, May 5, '94).
>
> In women the topical application may be in the vagina, as it combats the cystitis of the neck. Lutaud (Jour. de Méd., July 22, '94).
>
> In order to obtain the desired effect from belladonna, very small doses should be given at frequent intervals. When given in this manner in fevers, or hypodermically in cholera infantum and pernicious intermittents, it has proved a most valuable remedy. As a stimulant to the respiratory nerve-centres it has a place in pneumonia, and in enuresis it gives excellent results, if the doses are increased until a toxic effect is obtained. To augment peristalsis, it should be used in suspected fæcal or mechanical obstruction of the bowel.

In the so-called spurious hydrocephalus it is beneficial in maintaining cerebral vitality. I have many times by its use averted coma in typhoid fever after Cheyne-Stokes respiration was present. Larrabee (Pediatrics, Sept. 1, '96).

In angina pectoris Massy extols belladonna or its alkaloid, but Huchard denies any good effects and adds: "It disturbs the mechanism of the heart and contracts the arteries," which seems most tenable, being in line with the known physiological action of the drug.

CUTANEOUS DISORDERS.—Belladonna is useful in certain affections of the skin, in the cutaneous neuroses, prurigo, herpes zoster, erythema, and eczema. Sufficiently large doses to maintain a mild physiological action must be used. Hyperidrosis and unilateral sweating are arrested by the internal or by the local application of the belladonna preparations.

[The use of atropine in relieving the sweats of phthisis has been referred to under ATROPINE.—ED.]

In doses of from $^{2}/_{15}$ to $^{1}/_{3}$ grain of the extract, belladonna is the best remedy in chronic urticaria, which appears to be due to an acute œdema of the connective tissue of the skin as the result of active vasomotor dilatation. Liégeois (Revue Méd. de l'Est, Nov. 15, '90).

For the pruritus of lichen, fractional doses of tincture of belladonna; give 1 to 4 drops, three times a day. If an urticarial element exists, quinine with ergotine may be used where belladonna fails. Brocq (Gaz. des Hôp., Feb. 20, '92).

In a case of pemphigus, in a boy aged 15 years, 3 drops of tincture of belladonna, three times a day were given; at the end of a week increased to 4 drops. Decided improvement now set in, and for about a week no new vesicles formed. A few new blisters then appeared, and the belladonna was increased up to 6 drops three times daily. One of the best-known actions of belladonna is its power of controlling perspiration, and in doing this it put the lad's feet in the same condition in this regard in summer as in winter. Montgomery (Med. News, Nov. 16, '95).

EXTERNAL USES. — Belladonna used externally (liniment, ointment, or plaster of belladonna; or atropine) in solution is of value in the treatment of swollen lymphatic, parotid, and other salivary glands and the mammæ. It may be applied over sprained or inflamed joints. The application of a mild sinapism, to redden the skin slightly, will increase the efficiency of the belladonna. In blepharospasm the extract or ointment may be rubbed on to the eyelids externally.

In recent typhlitis with acute exacerbations give full warm baths, lasting half an hour; every hour a teaspoonful of a purgative mixture made up of 1 part each of castor-oil and oil of sweet almonds and 2 parts of syrup of lemon, until active purgation is established; mercury and belladonna ointment over the cæcum; and then hot linseedmeal poultices. For recurrent typhlitis there should be treatment in the intervals with a diet that leaves little residue, and with counter-irritation and belladonna ointment over the cæcum, the bowels being kept regulated and intestinal antiseptics administered. Grasset (Revue Gén. de Clin. et de Thér., Dec. 6, '93).

In ileus apply a compress of fifty square centimetres [about three inches square, ED.] coated with belladonna extract mixed with a little vaselin. If, some hours after this application, symptoms of atropinism supervene, an enema of ox-gall is given, which often relieves intestinal obstruction. In appendicitis, after the acute period, a compress eight by three inches, coated with extract of belladonna and potassium iodide, of each, 1 drachm; lard, 1 ounce, is useful; the action of potassium iodide on the skin promotes the absorption of the belladonna extract contained in the ointment. A suppository containing 1 grain of belladonna extract should also be used every eight hours. As soon as the first

symptoms of intoxication appear, a soap enema with ox-gall and sodium carbonate should be administered; this produces a copious and easy stool without irritating the affected intestine. Byers (American Medico-Surg. Bull., Jan. 15, '94).

C. Sumner Witherstine,
Philadelphia.

BENZOIC ACID. — Benzoic acid is a peculiar principle and is had from many different sources. It is made by oxidation of toluene with nitric acid, which is the most common form. It is derived, also, from the different benzoins, Asiatic and American; from urine, etc. The best, however, is that made from Siamese benzoin, technically known as peniformic acid, and presents white, pearly plates or needles, though with age and exposure to light it sometimes acquires a slight-yellowish tinge. It possesses an agreeable aromatic odor and taste, and is soluble in the proportions of 1 to 500 in cold and 1 to 15 in boiling water; 1 to 2 in alcohol; 1 to 3 in ether; 1 to 7 in chloroform; 1 to 10 in glycerin. Borax or sodium phosphate increases its solubility in water. With different bases it forms very soluble salts.

Preparations and Doses. — Benzoic acid, 10 to 30 grains.

Benzoate of ammonium, 10 to 30 grains.

Benzoate of bismuth, 10 to 20 grains.

Benzoate of calcium, 5 to 15 grains.

Benzoate of iron, 2 to 6 grains.

Benzoate of lithium, 15 to 30 grains.

Benzoate of mercury, for external use only.

Benzoate of potassium, 5 to 20 grains.

Benzoate of sodium, 30 to 120 grains.

Benzoate of zinc, for external use only.

Physiological Action. — Externally benzoic acid and, in less degree, its salts are irritant, and the vapors when inhaled tend to bronchial irritation and catarrhal inflammation. Internally administered in ordinary therapeutic doses it exerts no untoward effects except, perhaps, to provoke a moderate amount of gastric irritation with resultant nausea and vomiting. Sometimes there is acceleration of the heart's action and of respiration.

Schreiber took in two days about ½ ounce of the acid, and experienced only a feeling of abdominal warmth, spreading over the whole body, and accompanied by an increase of the pulse-rate amounting to 30 beats per minute; also increased reaction and excretion of phlegm, with slight disturbances of digestion. H. C. Wood ("Principles and Practice of Therapeutics," ninth ed.).

Benzoic acid and the benzoates are eliminated mainly by the kidneys, partly as benzoic acid, but chiefly as hippuric acid. The exact method by which the latter acid is produced constitutes one of the great problems of physiological chemistry, though the change is generally presumed to take place in the kidneys; certainly it does not happen in the intestines or in the blood.

The benzoates generally, yet in less degree, evince much the same action as the acid. The ammonium salt borrows from its base a neutralizing action upon acids and increases the activity of the kidneys. Benzoate of bismuth resembles other salts of the same base. Calcium benzoate, as might be expected, combines in a measure the action of both base and acid. As it is unofficial, and in little use or repute, it demands no further mention. The same remarks practically apply also to the iron salt. The lithia salt is supposed to possess a special affinity for uric acid and urea, dissolving the one and eliminating the other, but the claims made in this direction are by no means substantiated. It is eliminated by the kidneys the same

as benzoic acid, but more frequently yields succinic instead of hippuric acid: a phenomenon that is most puzzling. Potassium benzoate presents nothing from a physiological stand-point that does not accrue to other salts, except it is more difficult of elimination than the sodium salt; the latter most closely resembles the acid in its action, but is more readily absorbed and more continuous in its effects.

Therapeutics. — Benzoic acid externally employed is an antiseptic of considerable value, and both benzoate of bismuth and benzoate of zinc have been lauded and exploited in connection with surgical dressings. All are practically unobjectionable and devoid of unpleasant odor; hence may be made available when more acrid and unpleasant agents are inhibited. Indeed, there is little doubt, in antiseptic surgery benzoic acid might in a majority of instances be substituted for carbolic or salicylic acid with benefit. Friar's balsam—balsamum traumaticum of the old pharmacopœias—was formerly in great repute as a vulnerary, and the experiences of Mr. Bryant, of London, evidences its value: He, when confronted with a compound fracture or other severe wound, dresses with lint thoroughly saturated with this compound tincture of benzoin and maintains absolute quiet with non-removal of dressing for several days; and his results challenge those obtained by the most complicated antiseptic dressing. It is, perhaps, needless to remark that the value of the tincture, or "balsam," lies in its contained benzoic acid.

Internally, also, the acid is an antiseptic of no mean value; the salts also in proportion; though the best, when desired to exhibit for this purpose alone, is undoubtedly the benzoate of bismuth, which contains about 25 per cent. of the acid, and if desired may be given in quite large doses, even larger than those here indicated. Either the acid or this salt in medicinal doses is comparatively innocuous. As an antipyretic, too, benzoic acid has won some reputation, and it is as infinitely to be preferred for this purpose over salicylic acid as are its salts above those of the latter.

In the treatment of cystitis, with alkaline or ammoniacal urine, the acid has won golden opinions, though here its ammonium salt is generally preferred as being more active and less likely to disturb the stomach.

In conditions of urinary alkalinity short of phosphatic cystitis, ammonium benzoate is very beneficial, the condition of irritability of the bladder or incontinence of urine associated with an alkaline urinary reaction being almost invariably relieved by its administration. (Foster.)

It is said to sometimes act very happily in acute gonorrhœa, but it must be admitted that it is a somewhat uncertain remedy. The bismuth salt may, however, substitute other bismuth preparations in preparing injections.

Benzoate of lithia is very soluble in water and has been recommended in painful arthritic affections of the joints. Clement prefers it to either the salicylate or carbonate. It is an excellent diuretic, and certainly is often useful in the management of chronic gouty or rheumatic conditions. Its use has also been proposed in the management of uræmic cases, while it may be of service in relieving local manifestations; in the main, it is not to be depended upon.

Benzoate of sodium is the most widely employed of all the salts, that of lithia, perhaps, excepted,—probably, as before remarked, because it more nearly resembles benzoic acid in physiological

action. Bucholtz claims that it even surpasses the acid as an antizymotic.

> It is an excellent diuretic which stimulates the mucous membranes in general, except those of the liver, and it tends to increase and promote organic exchange. It is frequently indicated in uric and hippuric diatheses, in general, and in gouty affections. It is to be recommended equally in subacute and chronic rheumatisms, and some authors appear to have employed it with equal success in acute rheumatism. In the chronic variety it is well to associate it with the salts of lithia, with which we have had most excellent results. Von Renterghem and Laura (Dosimetric Med. Review, Oct., '97).
>
> Sodium benzoate has a positive influence in preventing alkaline fermentation in urine. Of a number of samples of urine exposed to the air of the laboratory for several days, none became alkaline. The effect of benzoic acid does not directly increase the normal acid of the urine, but the ammoniacal fermentation is prevented and the normal acidity asserts itself. The beneficial effects obtained in many cases of cystitis, where there is no ammoniacal fermentation and no residual urine, would indicate that this substance has an antiseptic or germicidal action. This influence, however, is not exerted on all forms of bacteria. The diuretic action of the substance is inconstant. W. W. Ashhurst (Phila. Med. Jour., Feb. 24, 1900).

It has been employed, more especially in Germany and Scandinavia, in the management of certain infectious diseases, notably mumps, whooping-cough, measles, scarlatina, and diphtheria, and even claimed, when the administration is begun prior to the period of incubation, to be a prophylactic to all. But the evidence adduced is of a somewhat flimsy character and requires better confirmation. Lutzerich and Klein used it in conjunction with calcium sulphide in diphtheria, with apparently most favorable results; but those who have had much experience in treating this malady realize how unsafe it is to draw deductions of a positive character from results accruing to a few cases in one epidemic.

Follicular Tonsillitis. — In affections of the throat it is used extensively. It is especially valuable in follicular tonsillitis.

> In 100 cases of acute follicular tonsillitis 4 to 15 grains of benzoate of sodium were given every one or two hours. The duration of the disease was shortened from twelve to thirty-six hours instead of lasting two to five days, as is usually the case. In some instances the white, cheesy points disappeared in eight to ten hours. L. C. Boislinière (St. Louis Courier of Med., Feb., '88).

Pharyngitis and Laryngitis. — In pharyngitis this medicament favorably modifies the pain, dysphagia, and inflammation of the pharynx, and often cures the affection in two or three days. In such cases it may be given in doses of 1 drachm to children, and 3 drachms to adults, in the course of the day.

> In laryngitis it is a good expectorant when administered at the beginning of the disease. Liégeois (Med. Press and Circular, Aug. 24, '92).

Gravel.—In uric-acid gravel salicylate of sodium, as does benzoic acid, changes the insoluble urates into soluble hippurates, and thus eliminates the acid from the urine.

In the treatment of Bright's disease, and as a cholagogue, this drug has been found of much service.

BENZOIN.—Benzoin is a gum or balsamic resin, the concrete juice of the *Styrax benzoin*: a large tree, native of Peru. It appears in lumps, agglutinated together, yellowish brown in color, with a milk-white interior. Benzoin has an agreeable balsamic odor, and a slight aromatic taste. It is easily pulverized,

the process being apt to excite sneezing. It is almost wholly soluble in five parts of moderately warm alcohol and in solutions of the fixed alkalies. Its chief constituents are resin and benzoic acid.

Dose.—Benzoinated lard (U. S. P.), 2 per cent., is used as the basis for benzoin ointments; tincture of benzoin, 10 to 40 minims; compound tincture of benzoin, 15 minims to 1 drachm.

Physiological Action. — Benzoin possesses antiseptic properties, and the added stimulating effect upon mucous membranes explains its value in the treatment of diseases of the respiratory tract. It is used principally in pharmacy for the preparation of benzoic acid.

Therapeutics.—Benzoin was formerly employed as an expectorant in pectoral affections, but has fallen into disuse. In the treatment of diseases of the upper respiratory tract, however, it has maintained a well-deserved reputation.

Acute Laryngitis. — In this disease rapid results are attained by the use of inhalations of the steam of a pint of hot water, containing 2 drachms of the tincture of benzoin, provided the patient is given at the same time 5 grains of the benzoate of sodium every two hours. The hot solution of benzoin is placed in a previously warmed vessel and, the latter being covered with a towel folded into a cone, the patient inhales through the upper opening of the latter. (Sajous.)

Anal Fissure.—The tincture of benzoin is being strongly recommended in anal fissure. It is used to paint over abrasions and excoriations in order to protect the surface.

Chapped Hands and Fissured Nipples. —When in cold weather or through the use of hard water, the hands become chapped and fissured, a mixture of the compound tincture of benzoin and glycerin, equal parts, is of great service. The same preparation is advantageous in fissured nipples.

Abrasions, Chilblains, Wounds, Bedsores, and Granulating Surfaces.—Owing to its antiseptic virtues, its stimulating properties, and the fact that it protects the parts over which it is painted with a thin film, the compound tincture, painted over any of the above local disorders, is productive of much good.

Eczema, Pityriasis, Urticaria, and Frost-bite. — The tincture of benzoin, 2 drachms; glycerin, 2 drachms; and rose-water, 4 ounces, used as a lotion may be applied with advantage to either of the above skin disorders. In frost-bite, however, the compound tincture, applied locally, is more effective.

> Tincture of benzoin useful in scabies. In two cases the itching ceased, and the eruptions began to disappear after the first application, and the patients were finally cured. Vladimir de Holstein (Jour. des Mal. Cutan. et Syph., Apr., '97).
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> Liquid benzoin for benzoinating lard may be made by macerating for twelve hours benzoin, 20, in ether, 40; it is filtered and castor-oil, 15, is dissolved in the filtrate, from which the ether is carefully distilled. This oily product contains the benzoic acid and the volatile principles. To make benzoinated lard, white wax, 20, is melted by steam heat with dehydrated lard, 965, to eliminate water; the above liquid, 15, is added and the mixture stirred until cold. In warm weather a large amount of wax should be used. R. M. Shoemaker (Amer. Jour. of Pharmacy, No. 1, p. 9, '98).

BENZONAPHTHOL. See NAPHTHALIN.

BERIBERI.—Jap., *kakké.* It has been suggested that the term is from *bhérbheri*, a Hindoo word meaning a sore or swelling; or from *b'here*, a sheep, from the fancied resemblance between the gait of sufferers from this disease and the

jerky movements of sheep; or from the Cingalese word *beri-beri*, meaning "great weakness." The latter etymology is almost surely the correct one.

Definition. — A probably specific endoepidemic disease characterized by multiple peripheral neuritis, in which there is numbness and stiffness of the limbs, paralysis of the extremities, pain and tenderness on pressure, paræsthesiæ, and abolition of the tendon reflexes, together with frequent anasarca, cardiac irregularity, and gastro-intestinal disorder, often terminating in death.

Symptoms. — Two forms of beriberi are met with: the œdematous, sometimes termed the "wet" form, and the paralytic, or "dry" variety. The œdematous form is characterized by general anasarca, with the appearance of great anæmia. It usually begins with fever, which may be slight and intermittent. Œdema of the extremities then sets in, beginning usually over the dorsum of the foot and extending upward. As the serous effusion into the subcutaneous cellular tissue takes place, puffiness and numbness follow. A peculiar localized thickening of the tissues, or "solid œdema," is sometimes observed over the shin and in the thighs and chest. With the beginning œdema, cardiac symptoms are usually observed, this fact having caused some authors to attribute the effusions to the venous stasis resulting from dilatation of the right ventricle. The heart's action is irregular, rapid, palpitating, and frequent, the systole being somewhat increased in force and louder at the apex. Loud blowing murmurs, resembling the *bruit de diable* of exophthalmic goitre, with violent pulsation of the blood-vessels in the neck are present, as a rule.

In a great number of cases of beriberi the first heart-sound is observed to be so prolonged as to be considered by some authors as a sanguineous murmur. Besides this systolic murmur there is often violent palpitation, due to myocarditis, which may cause death, as does paralysis of the heart, from alterations of pneumogastric, recurrent, and vasomotor nerves, found in the disease. Albert Ashmead (Inter. Med. Jour., '93).

Study of the modification of electrical reactions, showing relationship between the acceleration of the pulse and the diminution of galvanic excitability, though not in all cases. Glogner (Virchow's Archiv, B. 132, p. 50).

The respiration is embarrassed, and præcordial pains are frequent.

As regards the digestive system, the tongue is usually pale and flabby. The appetite, normal at first, gradually becomes impaired; disorders of digestion are frequent and are occasionally accompanied by hæmatemesis. Constipation is almost the rule. The urine is usually high-colored and scanty, and contains no albumin, unless a concomitant affection be present.

The pale, blanched, and anæmic-looking cutaneous surface does *not* indicate true anæmia, since examination of the blood shows percentage of hæmoglobin slightly, if at all, lower than normal. E. D. Bondurant (N. Y. Med. Jour., Nov. 20, '97).

In the so-called "dry" form the nervous symptoms, which are also present in the œdematous cases, are most prominent. Pain, of a stinging, burning, and most distressing character, is frequent. Anæsthesia to touch and paræsthesia, the latter being represented by pricking, formication, and tingling (the *piri-piri* of the Japanese), are prominent symptoms, paresis of the extremities accompanying. Cramps are sometimes complained of. The knee-jerk is absent in almost every case, while paralysis of the diaphragm is not infrequent, this complication giving rise to dyspnœa.

Paralysis of the diaphragm is not uncommon in severe cases. Coughing is thus rendered very difficult, and dyspnœa is not uncommon; anæsthesia and paræsthesia are frequent, beginning, as a rule, in the region of the peroneal nerve. Miura (Virchow's Archiv, B. 123, H. 2).

The motor symptoms are usually well marked, and the gait of the patient is characterized by wobbly, inco-ordinate, and jerky movements, due to dropping and inversion of the foot. In advanced cases the power of locomotion may be entirely lost. In cases in which the morbid changes have an extensive distribution, the patient may be unable to move. The upper extremities are always involved in severe cases.

Special attention has been given in the Richmond Asylum to the condition of the joints. The relaxation of the ankle- and knee- joints is extreme in some cases, and is present probably in all. In many this condition permits the legs and feet to be placed in postures resembling those occurring in subluxations of the knee or ankle. This condition gives rise to a characteristic wobbling at the knee in walking, which the Japanese designate, according to Professor Anderson, by the term *gaku-gaku*. Editorial (Brit. Med. Jour., Aug. 14, '97).

Cases of beriberi, late stage, showing atrophy of muscles of legs and foot-drop. (*Bondurant.*)

Muscular atrophy may be a more or less prominent late feature of the case, that of the inferior extremities being the most pronounced. The joints are greatly relaxed, and foot-drop and wrist-drop are typically shown in the annexed cuts. In severe cases there may be contracture.

Electrical examination shows the reaction of degeneration, even in acute cases.

In the acute form, the symptoms outlined follow in quick succession, and death is exceedingly frequent. This is frequently mentioned as the "pernicious" form of beriberi.

Disease divided into three forms: 1.

Acute, with pyrexia, anæmia, anasarca, serous effusions, paralysis, and dyspnœa. 2. Subacute, with pain, atrophic paralysis, anæsthesia, loss of knee-jerk, mental debility, and œdema. 3. Chronic, with prostration, anæmia, œdema, and cardiac dilatation. Thomas (Edinburgh Med. Jour., Jan., '90).

Two characteristics not yet noticed: patients are subject to attacks of perspiration, ordinarily limited to the head, but sometimes general. In addition, two exceedingly sensitive points are to be

Case of beriberi, early stage, showing paralysis and foot-drop. (*Bondurant.*)

found on the feet: one toward the middle of the dorsal face of the first intermetatarsal space, corresponding to the bifurcation of the internal branch of the anterior tibial nerve; the other at the cuboid protuberance, corresponding to the external saphenous nerve. Previous to any treatment the patient should be withdrawn from the endemic surroundings. C. E. Corlette (Brit. Med. Jour., Sept. 28, '94).

Case of suddenly developing beriberi: œdematous paralysis with blindness. The patient suffered from optic neuritis with central scotoma and consequent blindness. The urine exhibited a sensible diminution of urea and an almost parallel decrease of other constituents. There was a decrease of the red blood-corpuscles and an increase of the leucocytes. In several muscles a partial reaction of degeneration was obtained, notwithstanding the return of voluntary motion. Mossé (Med. Bull., Jan., '95).

Series of seventy-one cases which, during 1895-'96, occurred among the patients in the State Insane Hospital, at Tuscaloosa, Ala. A striking feature of the disease was its variability in mode of onset. Some cases began suddenly with fever and gastro-intestinal irritation, as is commonly seen in the acute infections, the local neuritic symptoms appearing either simultaneously or after a few days. In other instances the onset was insidious, the initial vague aches, pains, and discomfort gradually crystallizing into the clinical picture of neuritis without fever or general systemic disorder, it being in many of these cases impossible to date the commencement of the attack. In still other cases the initial symptom was suddenly occurring dyspnœa, with tachycardia and violent pulsation of the vessels of the neck; œdema of feet and ankles was, in others, the first indication.

The temperature was, in about half of the cases, elevated in the beginning, but usually subsided to normal within a week or less.

The clinical manifestations of inflammation of the peripheral nerves varied in intensity, distribution, and character, but always consisted in weakness, perversion, or abolition of function of the affected nerve-trunk. In all cases the disease began in the nerves of the legs.

The sensory symptoms were frequently those to first attract attention: pain and tenderness in the area of distribution of the affected nerve, at first aching and not very severe, but becoming progressively more intense, and at its height very distressing.

The motor symptoms, appearing with or shortly after the sensory disorders, were: stiffness in muscles supplied by

affected nerves, progressing through simple weakness and disinclination to exertion to some degree of paralysis, this, in severe cases, becoming complete.

Vasomotor and trophic disorders, other than the œdema in affected parts, which is referred to below, were not frequent.

Almost without exception the portions of the body supplied by affected nerves grew œdematous.

The chief and earliest symptom of heart-implication is rapidity of action, with weakness. This begins about or shortly after the time the nerves of the body and arms become attacked.

The rapidity of heart-action in these cases will average about 130, but may show a higher rate. In one extreme case the pulse for three weeks ranged between 180 and 210, the patient suffering surprisingly little dyspnœa. E. D. Bondurant (N. Y. Med. Jour., Nov. 20, '97).

Diagnosis. — Beriberi prevails endemically in tropical and subtropical countries, especially in Brazil, the West Indies, India, and Ceylon. That it also occurs occasionally in temperate climates has recently been shown by the outbreaks at the Richmond Asylum, in Dublin, and the Insane Hospital at Tuscaloosa, Alabama. Its peculiar characters readily cause it to be recognized, and the diseases with which it can be confounded are few.

Malignant Dropsy.—This affection is less infectious and attacks exclusively the insane. Paralysis is never observed. The digestive tract is unaffected. The progress is slow, and in an epidemic very few persons are affected, differing in these respects from beriberi. (Melendez.)

Ceylon Anæmia.—This affection, due to the presence in the intestines of the *Anchylostoma duodenale*, is also characterized by weakness and numbness; but there are no true motor symptoms, and intestinal hæmorrhage is frequent (Kynsey). The anchylostomum is sometimes found in beriberi, and the two affections are considered as similar by some authors.

Anchylostomiasis is common in countries (such as Italy) where beriberi is not found. *Anchylostomum filaria sanguinis* or *Trichocephalus dispar* may be present in beriberi; but they are coincidents, and not a cause. Anchylostomiasis has symptoms not at all like beriberi. Giles (Indian Med. Rec., July, '90).

Anchylostomum duodenale, a human parasite found in tropical countries, and especially in Ceylon, gives rise to grave anæmia, often ending in death. This affection, the kala-azar, or beriberi, of Ceylon, bears no resemblance to the true beriberi, except a cachexia, often accompanied by muscular weakness and dropsy. Giles (Indian Med. Record, July, '90).

Two cases of beriberi associated with *Distoma crassum*, *Anchylostoma duodenale*, and other parasites. James Walker (Brit. Med. Jour., Dec. 5, '91).

Beriberi a peripheral neuritis, independent of the presence of anchylostoma; the affection produced by the latter is absolutely distinct from beriberi. Leslie (Brit. Med. Jour., Feb. 27, '92).

Beriberi and the kala-azar of Assam are identical; the latter an anchylostomiasis caused by the *Dochmius duodenalis*. Giles (N. Y. Med. Jour., Mar. 26, '92).

In beriberi (endemic neuritis) we must look for the characteristic cardiac and nerve symptoms and the reaction of degeneration.

In anchylostomiasis (parasitic anæmia) we must search for the worm after the exhibition of thymol, or by microscopical examination of a portion of the excreta for the ova of the parasite.

In kala-azar (epidemic malarial fever), which is confined to Assam, we have the history of the sure and slow spread and evidence of its infectiveness.

The co-existence of malarial cachexia with either beriberi or anchylostomiasis, as very frequently happens in tropical countries, renders an exact diagnosis sometimes difficult, and it is this fact which, in countries where malaria is very

common, has stood so much in the way of clear ideas on the above diseases. W. J. Buchanan (Dublin Jour. Med. Sciences, Dec., '97).

An epidemic of peripheral neuritis is probably one of beriberi. When, in the beginning, the symptoms are indistinct, the subsequent rapid development of œdema and paresis, in the absence of any other cause—*e.g.*, nephritis—points to that disease.

Malarial neuritis of a character simulating beriberi is exceedingly rare. It is generally confined to one nerve; besides, paresis, muscular atrophy, and cardiac disturbances are absent. If the plasmodium of Laveran is found and the disease responds to quinine, the diagnosis is cleared up; both diseases may co-exist.

In alcoholic neuritis we have, besides a history of drinking, gastric catarrh and mental disturbances. Œdema is infrequent in uncomplicated cases. It is possible, however, for malaria, beriberi, and alcoholic neuritis to be present in the same patient.

In lathyrism, due to the poison of the *Lathyrus sativus*, there is no œdema, anæsthesia, or cardiac disturbance.

In trichinosis the pain is principally in the muscles of the trunk, head, and neck. Violent gastro-intestinal paroxysms precede the muscular pain. Cardiac trouble and paresis are absent. O. D. Norton (Indian Lancet, June 16, '98).

Polymyositis, polyneuritis, and Landry's paralysis have so many symptoms in common with beriberi that they are probably to be considered as sporadic cases of that disease. Ebbell (Norsk Mag. f. Laegevidensk., p. 629, '99). F. Levison, Corr. Ed.

Etiology. — Until recently a great diversity of opinion has existed regarding the cause of this affection. The researches of Pekelharing and Winkler have increased the probability that beriberi is caused by the presence, in food and infected habitations or ships, of a specific micro-organism.

In the blood of beriberi patients bacilli and micrococci are to be found. Pure cultures of these micrococci give a nerve-degeneration of like nature to that found in beriberi when injected into rabbits and dogs. The inhalation of air impregnated with such culture can originate a nerve-degeneration in rabbits. Beriberi must, in all probability, be regarded as a contagious disease induced by the action of a micro-organism. The infecting micrococcus can also exist apart from contact with the human being.

Direct transmission from one person to another rarely occurs; infection through wearing-apparel is more common. The infecting material finds its way into the body principally through the respiratory organs. The spread of the malady can be interrupted by disinfection, or, in a person attacked, by removal; when the symptoms are once well developed nothing but Nature can effect a cure. Pekelharing and Winkler (An Investigation into the Nature and Origin of Beriberi, and the Means to be Adopted for Counteracting the Disease, '88).

Examination of 20 specimens of hair from beriberi patients. Nineteen specimens were obtained from Penang, and 1 from India. Out of these 20 specimens, 6 contained arsenic. The specimens which contained arsenic were obtained from recent cases, while nearly all the negative specimens came from older cases. This result augments the evidence in favor of beriberi being due to arsenic, since it suggests that the arsenic was present only at a certain stage of the disease. R. Ross (Brit. Med. Jour., Feb. 8, 1902).

While the discovery of the specific micro-organism is yet to be verified, clinical evidence has shown that overcrowding, as in the case in ships, associated with defective and noxious ventilation and moisture and oftentimes insufficient or improper diet, tend to cause the development of the disease. By thus debilitating the system and rendering the latter amenable to the pathogenic effects of the germ, such untoward conditions of life might act as an indirect factor.

Living in a confined atmosphere and in districts favorable to cryptogamic vegetation has considerable influence in the production of beriberi. Agapito de Veiga (Int. Med. Jour., Aug., '93).

Whole crew affected in ship loaded with fermenting Manila hemp; also in another vessel loaded with fermenting cocoa-nut fibre. Ashmead (N. Y. Med. Rec., Nov. 24, '94; Univ. Med. Mag., Aug., '95; N. Y. Med. Rec., Oct. 5, '95).

Regarding the epidemic at the Richmond Asylum, Dublin: "Not only is the whole institution overcrowded far beyond its normal accommodation, but even the new wooden building for males is not fit to contain more than half the number at present occupying it. Its two dormitories are at present occupied by 100 patients, although not suited to give sanitary accommodation to more than 50. The women's permanent hospital contains as many as 63 patients, who have an average of 451.968 cubic feet of space each." This space ought properly to suffice for the accommodation of 25 patients. Sir Thornley Stoker (Boston Med. and Surg. Jour., Aug. 12, '97).

In addition to bad ventilation and overcrowding, it is also recognized that insufficient diet encourages the development of the disease. But it should be borne in mind that these conditions foster, but do not generate, beriberi. The morbid entity which causes it must be imported into the locality in which the vicious environment prevails: an environment which is eminently favorable to the development of many other epidemic diseases. Editorial (Lancet, Aug. 14, '97).

In the seventy-one cases which occurred in the Insane Hospital at Tuscaloosa, Ala., the first case developed in February, 1895. The disease was not again seen until November, 1895, when almost simultaneously seven cases developed among the white female patients. During the succeeding six weeks five cases made their appearance, all of similar type. After a period of immunity the disease reappeared in the late summer of 1896, when, following a season of unusual dryness and distressing heat, fifty-eight patients were attacked. Statement giving the average population of the hospital during the period covered by the outbreak:—

	WHITE.		NEGRO.		
	Men.	Women.	Men.	Women.	Total.
Approximate number of patients in hospital	650	135	140	165	1200
Number of cases of beriberi	43	21	6	1	71
Fatal cases of beriberi	11	4	5	1	21
Number of epileptics in hospital	45	15	15	5	80
Number of cases of beriberi in epileptics	25	5	2	0	32

Peculiar distribution among the several classes of insane patients: every one of the seventy-one patients attacked was the subject of a psychical degenerative form of mental disorder. E. D. Bondurant (N. Y. Med. Jour., Nov. 20, '97).

Beriberi was endemic in the government asylum at Singapore from 1887 to 1900, the deaths averaging 45 per annum, and the cases about 150. Since 1900 the disease has nearly been stamped out. Two small isolated wards were constructed to which all cases of beriberi were sent on the first manifestation of the disease. The wards are washed out with bichloride solution weekly, and all clothes and bedding disinfected twice a week. All patients are bathed half an hour daily, and kept in the open all day. Only 5 deaths have occurred in two years. All the patients are fed on Siamese rice, the author's observations having convinced him that rice has nothing to do with the disease. He thinks it a place disease—that the soil and buildings become infected and that people dwelling there are liable to absorb the poison, whatever it is. Ellis (Brit. Med. Jour., Nov. 14, 1903).

The nature of the food, as shown in the results obtained by a change of diet in the Japanese navy, has an important bearing upon the development of the disease. The influence is but an indirect one, however, operating also by preparing the field for microbic infection, the latter only taking place when the person enters an infected abode.

Success in controlling a considerable number of cases of beriberi in the Japanese navy, by adopting a food-regimen in which rice is, for the greater part, replaced by beef, pork, eggs, etc. Of 3063 cases per million in 1883, in 1889 there were only 388. Takaki (Brit. Med. Jour., Sept. 24, '92).

Three cases in which the cause of the disease seemed to be the use of old preserves, in which, however, the pathogenic agent was not to be found. Kirchberg (Gaz. Med. de Nantes, Dec. 12, '93).

Ascribed to eating diseased tunny-fish. It was common in the Japanese navy until fish was abolished from the diet; vegetable-eating prisoners are also exempt. Miura (Virchow's Archiv, vol. cxix).

Cases in which microscopical and bacteriological examination showed blood to be free from any parasites. Disease probably due to toxæmia caused by ptomaines derived from special kinds of food. Judson Daland (N. Y. Med. Jour., Mar. 9, '95).

A toxæmia of alimentary origin (rice, fish); for cure, European rations indicated. Grall, Porcé, and Vincent (Revue Inter. de Méd. et de Chir., July 10, '95).

In stamping out the disease in the Japanese navy, however, besides the improved dietary, very important hygienic improvements were introduced at the same time. D. C. Rees (Brit. Med. Jour., Sept. 18, '97).

The seventy-one cases at Tuscaloosa seemingly due to use of water contaminated by decaying vegetable matter. E. D. Bondurant (N. Y. Med. Jour., Nov. 20, '97).

Attention drawn to spread of this disease to suckling infants through the milk of nursing mothers suffering from it. Of 52 cases in such infants, 42 recovered and 5 died, the result in the remaining 5 cases being unknown. Cows' milk or condensed milk was mostly substituted for human milk. Improvement occurred almost at once. It is personally maintained that the disease is really due to an intoxication brought about by the milk, and that the only sure cure is to withhold the milk, and this before the disease is too advanced. Hirota (Centralb. f. innere Med., Apr. 23, '98).

Cold and damp have been regarded as etiological factors, the disease occurring most frequently on board of ships during the winter, probably owing to the fact that those exposed are more likely to remain huddled together in close quarters than during other seasons. The recent epidemics at the Richmond Asylum and at Tuscaloosa, Ala., however, occurred during the warm months, and the latter during a period of excessive dryness.

Negro paranoiac, of a degenerate type which seemed especially susceptible to the poison of beriberi. (*Bondurant.*)

Two epidemics of beriberi occurring on board ship, which appear to prove very conclusively that this disease is propagated through the drinking-water. In both cases the men were healthy as long as they still had a supply of European water, although staying for some time

at places where the disease is endemic. But, the water having run short, they had, in the one case, to lay in fresh water at Batavia and, in the other, at Mauritius, in both of which places the disease occurs endemically. About four weeks after commencing to drink this water the disease broke out among the crew. It would thus, also, appear that the incubation period of beriberi is about one month. Roll (Norsk Mag. f. Laegevidenskaben, Nov., '95; May, '96).

European or mulatto contracted beriberi, there were 45 cases among the aboriginals. Length of residence in the jail and want of occupation, together with overcrowding, defective ventilation, inadequate provisions for cleanliness, and the removal of filth were the chief determining causes. The affection generally commenced toward the third month of incarceration. Compulsory exercise was invariably followed by an amelioration of symptoms, but if the patient remained

Imbecile and paranoiac imbecile, illustrating types of degenerates most liable to beriberi. (*Bondurant.*)

Case of beriberi on top of Fujiyama, Japan, in the month of December, ascribed to insufficient alimentation and constipation. Miura (Sei-I-Kwai Med. Jour., June, '96).

At the Dakar prison in Senegal, western Africa, the total number of prisoners under observation in 1895 was 647, of whom 52 were Europeans, the remainder being natives. The two classes lived under identical conditions; whereas no

in prison a relapse ending fatally was sooner or later certain to supervene. Of twelve prisoners suffering from beriberi for whom pardon was asked in order that their lives might be saved, five were dead before the official intimation reached Dakar three months later. The seven survivors were at once set at liberty, and eventually all of them recovered. Unhygienic conditions an important factor, but the chief cause of the

disease is the lack of suitable employment. Lasnet (Archives de Méd. Navale et Coloniale, Feb., '97).

Marked predominance of the number of outbreaks that occur in the wet and cold months of the year, when, presumably, the native sailors will remain huddled up in their stuffy forecastle. Out of the 157 cases recorded, 96 occurred between October 1st and February 28th; the remaining 61 occurred between March 1st and September 30th. It has been shown that in a certain group of vessels, all drawing their food-supply presumably from the same source, in only one-half of their number did beriberi occur; and, further, that one epidemic undoubtedly renders a ship liable to future outbreaks.

The history of the outbreaks at the Richmond Asylum tends to prove that beriberi is a "place" disease and not a "food" disease. It is highly improbable that the same food-supply was used in this asylum during the epidemics of 1894, 1896, and 1897. With all these facts before us, we are justified in adhering to the belief that an outbreak of beriberi depends on "place" infection plus favorable predisposing conditions. D. C. Rees (Brit. Med. Jour., Sept. 18, '97).

Forty-five deaths from this disease among 506 men of the Australian pearling fleet, in voyages lasting altogether 53 months. They sustain the view (1) that beriberi is confined to a very great extent to rice-eating races, and with proper care will not develop in less than sixteen months; (2) that the substitution of a mixed diet of wheat-flour, beans, potatoes, etc., to the exclusion of rice, mitigates, even if it does not prevent, the disease. Lime-juice is not very useful, but beer is very beneficial. T. H. Haynes (Jour. of Tropical Med., Mar. 15, 1900).

Epidemic of beriberi in a foundling-house. There had been one or two cases in a blind-asylum near by, the inmates of which came in contact with the children in the foundling-house. Sixty-nine cases occurred, and only 27 healthy children were left in the house. Two of the patients with beriberi died, the remainder were improving. The children attacked were all between 4 and 7 years of age. Their hygienic surroundings were good, and the diet was excellent. All those attacked slept on the ground floor. F. Clarke (Brit. Med. Jour., May 12, 1900).

Other factors in the etiology of the disease are fatigue, exhausting diseases, exposure to marked alternations of temperature, all conditions tending to sap the vital energies and reduce the nutrition of the nerve-centres, and to prepare the system for the attacks of the infectious principle.

Pathology.—Pekelharing and Winkler have obtained from the blood of beriberi patients a micrococcus which, inoculated in animals, produced polyneuritis. Ogata and Lacerda ascribe the disease to a bacillus resembling that of anthrax. Musso and Morelli have isolated four micro-organisms: a staphylococcus pyogenes albus; a micrococcus in chains; a small micrococcus; and, last, a small organism which, inoculated in dogs and guinea-pigs, produced a universal degenerative neuritis.

It cannot be said, however, that the specific organism of beriberi has been found. All that can now be admitted is that it infects asylums, barracks, prisons, the holds of ships, and other abodes where the hygienic surroundings are deficient.

The researches of Baelz and Scheube, in Japan, and those of Pekelharing and Winkler, in Java, have done much to elucidate the pathology of beriberi. The former ascribed to a multiple neuritis the symptoms of the disease, while the latter observers advanced and upheld with powerful evidence the view that the staphylococcus was the primary factor in its production. The disease is mainly one of the peripheral nervous system, which shows, in various regions remote from the cord and brain, more or less pronounced degeneration.

Results of fourteen autopsies. In the brain and spinal cord nothing abnormal found except the presence of vacuoles in the ganglion-cells of the spinal cord: a fact of little significance. In almost all of the cases there were cardiac hypertrophy and dilatation. The muscular tissue of the heart usually appeared normal, fatty degeneration was rare, but in two cases there were many granular cells in the interstitial tissue of the heart-muscle. There were no characteristic changes in the lungs. In a number of cases the kidneys showed alterations in structure, usually in the form of glomerulonephritis. The liver was usually of the nutmeg variety, and the spleen normal. The muscles very commonly showed the "waxy degeneration" described by Zenker and also a multiplication of the nuclei of the sarcolemma and an increase in the connective tissue. Miura (Virchow's Archiv, Feb., '88).

North Brazil as the father-land of the disease, from which it has been spread by commercial intercourse with other nations. Two forms: the œdematous and the paralytic. Four forms of bacteria. W. Leopold (Berliner klin. Woch., No. 4, '92).

Four micro-organisms were isolated, as follows: (1) staphylococcus pyogenes albus; (2) micrococci in chains; (3) a small streptococcus, colorless, of unknown character and difficult cultivation; and (4) a micrococcus which, by inoculation in guinea-pigs and dogs, causes a degenerative neuritis, and is described as the micrococcus of beriberi. Musso and Morelli (Berliner klin. Woch., Jan. 25, '93).

Beriberi due to a bacillus cultivated from rice; the same found in the blood of rats that had died after eating the rice. De Lacerda (Bentley: "Beriberi"; Scheube: "Die Beriberi-Krankheit").

Organism sought in the blood of patients while alive. Numerous micro-organisms—cocci and rods—found.

Inoculative experience leading to the conclusion that a white micrococcus cultivated from the blood is the cause of beriberi. These white cocci impregnate the air of the infected houses, ships, and districts, get into the human circulation through the air-passages, and when they are absorbed in sufficient amount—some weeks' exposure to the infection being necessary—produce in the blood toxins in such quantity and of such a nature as to bring about a parenchymatous degeneration of the peripheral nerves. Pekelharing and Winkler ("Beriberi," Edinburgh, '93).

Pekelharing and Winkler did not produce beriberi in the animals injected; the cocci found by them are not the cause and not even one of the causes of the disease. Beriberi cannot probably be produced by several organisms, as suggested. The cause of beriberi has not yet been ascertained. Scheube ("Die Beriberi-Krankheit," '94).

Bacillus, found in the spinal cord of a patient who had died from beriberi, resembling the anthrax bacillus. Cultures injected in mice and dogs caused the development of the symptoms of beriberi. This bacillus being found in the intestines of patients, conclusion reached that it was the toxins of these bacilli being absorbed into the circulation that caused the paralytic symptoms. Ogata (Bentley: "Beriberi"; Scheube: "Die Beriberi-Krankheit," '95).

A micrococcus cultivated from the blood and ascitic fluid of two cases of beriberi, which, when injected into rabbits, produced symptoms of beriberi. Musso and Morelli (Sternberg's "Bacteriology," '96).

Cocci cultivated from the blood of beriberi patients; by inoculating rabbits with the growth the symptoms of that disease produced. De Lacerda (Sternberg's "Bacteriology," p. 473, '96).

In spite of the arduous researches of Pekelharing, Winkler, and others the organism which is the cause of beriberi has not been satisfactorily or certainly determined. Spencer (Lancet, Jan. 2, '97).

Four varieties of organisms cultivated from the blood of beriberi patients, as follows: (1) micrococcus albus: a micrococcus which was immobile, aërobic and which liquefied gelatin; (2) micrococcus tetragonum flavus: cocci arranged in tetrad forms; (3) micrococcus flavus: also aërobic and liquefying gelatin; and

(4) bacillus flavus: short rods in pairs and chains, in active motion, aërobic, and with spore-formation. On injecting animals with these growths, three of them—the first, third, and fourth—each produced paralysis. No result was obtained with micrococcus tetragonum flavus. Van Eecke (Scheube: "Die Beriberi-Krankheit," '97). The above nine abstracts quoted from an article by W. K. Hunter (Lancet, July 31, '97).

Two cases of beriberi, in both of which specimens of freshly-drawn blood showed micro-organisms in rapid motion in the spaces between the groups of corpuscles. Of 30 tubes of culture-media (agar-agar and bouillon-tubes) that were inoculated with the blood 3 growths were obtained from one case and 1 from the other. These presented all characters of staphylococcus of beriberi. Three of the cases were pure and one a mixed infection. Pathogenic properties of the staphylococci found were determined by injecting rabbits. Hunter (Lancet, June 25, '98).

Experiments showing that the blood of a patient suffering from beriberi contained a substance that caused a fall of arterial pressure when injected in the veins of animals. The same result is caused by the choline found in the cerebro-spinal fluid from cases of general paralysis of the insane. The presence of choline in the former case could not be proved chemically. Mott and Halliburton (Brit. Med. Jour., July 29, '99).

Metabolism in beriberi is seriously diminished. The amounts of urea, phosphoric and sulphuric acids may be very greatly reduced; it is suggested that the contributing organs—for example, the liver—are seriously disturbed in their output, which is in accordance with the fact that patients complain of illness before the onset of marked symptoms of the involvement of the peripheral nerves. The conjugated sulphuric acids and the neutral sulphur do not appear to be proportionately diminished. The purin bodies do not seem to be of great interest in beriberi; as might be anticipated, they were abundant in the critical urination of a highly œdematous case. In a number of Tamils, on comparatively liberal diet, in whom no beriberic symptoms were detected, the excretion of urea and phosphoric acid was found to be remarkably low, though their uric acid was high. H. E. Durham (Brit. Med. Jour., Feb. 27, 1904).

When the disease has advanced, the various organs are infiltrated with serous fluid, and the tissues, especially the muscular, undergo degeneration. The heart is enlarged, and the kidneys also present marked evidence of degeneration.

Histological examination; conclusion that the disease is an infectious lesion rapidly destroying the epithelium of the kidneys, liver, and muscles, particularly the cardiac fibres, by granulo-fatty degeneration; it causes the production of masses of new cells in the connective tissue of the liver, spleen, kidneys, spinal marrow, and brain and certain nerves, the vagus in particular. Nepveu (Marseille-médical, June 15, '94).

Series of seventy-one cases which, during 1895-96, occurred among the patients in the State Insane Hospital at Tuscaloosa, Ala. Of the 21 fatal cases, 1 patient died of pulmonary tuberculosis, 1 of pneumonia, 2 in the *status epilepticus*, 14 directly from heart-failure, and the remaining 3 from a combination of causes. The complications hastened or insured a fatal termination in 6 or 7 cases. E. D. Bondurant (N. Y. Med. Jour., Nov. 20, '97).

In general, it may be said that, the nearer the equator, the more numerous the hydropic forms and the greater the mortality. The mortality is always high when the patients continue to live under the same conditions and in the same place as that in which the disease was contracted. The lethal complications are respiratory and cardiac failure and bronchitis. O. D. Norton (Indian Lancet, June 16, '98).

Prognosis.—The mortality of beriberi varies considerably in different epidemics, and may range from 8 to 44 per cent. On shipboard the number of deaths may surpass that proportion.

Beriberi may cause death in three ways, these being, in the order of frequency, by failure of the heart from peripheral paralysis of its special nerves; by suffocation from congestion and œdema of the lungs; by effusion into the pericardium. (Max Simon.)

A peculiarity of this disease is its tendency to relapse, and the fact that with each relapse the prognosis becomes much more unfavorable.

Treatment. — The first step should naturally be to remove the patient from the unhygienic surroundings in which he may find himself, and especially from germ-infected abode. Out-of-door life and suitable diet are the primary elements of cure.

As to remedial measures, the symptoms should be treated as they occur, there being no specific remedy at our disposal. The œdema should be met with acetate of potassium, squill, and digitalis. Cathartics may be administered to antagonize the constipation, opium to arrest the pain, and camphor, digitalis, and strophanthus be given when cardiac symptoms appear. Diaphoretics and hot vapor-baths are useful in the œdematous form, unless they debilitate the patient. When there is marked dyspnœa ether, hypodermically, is of great service. Methylene-blue, 3 grains two or three times a day, was found very valuable by Thur, and salicylate of soda by Berry, of Boston. When the case is beginning to improve, electricity, judiciously employed, may prove of great benefit to stimulate the vasomotor system and increase the nutrition of the muscles. Massage also is valuable.

Strychnine, in gradually increasing doses until slight toxic phenomena are produced, is capable of bringing about a cure even when the paralysis is complete. The treatment is begun with $^1/_{60}$ grain, and the same quantity is added every third day until $^1/_6$ grain is taken. If the disease should return, the initial dose of $^1/_{60}$ grain should again begin the course of treatment. (Domingos Freire.)

> The berry of the *Phascolus radiatus*, a common plant, has proved effectual in the treatment of beriberi. It was thoroughly tested on the two hundred and fifty to three hundred inmates of the asylum, and displayed a marked prophylactic action when an average of 150 grammes of the peas were eaten regularly every day. No injurious effects of any kind were noted even after prolonged use. It also proved a good remedy against the infection itself, but had no influence on the sequelæ. The œdema rapidly subsided under its influence, and likewise the paresis in the acute cases, which is liable to persist for months. Its influence was particularly beneficial in the severer forms of the disease. The asylum has long been affected with beriberi, but not a single case has occurred in the pavilion in which the inmates take regularly 150 grammes of the peas in their daily ration. The natives make great use of these peas both in their own food and for poultry. Burg (Janus, Oct., 1902).
>
> E. D. Bondurant,
> Mobile.

BETANAPHTHOL. See Naphthalin.

BICARBONATE OF POTASSIUM. See Potassium.

BICARBONATE OF SODIUM. See Sodium.

BICHLORIDE OF MERCURY. See Mercury.

BISMUTH.—Bismuthum is a whitish-gray, hard, though brittle, metal, with melting-point at 286.3° C. It is soluble in nitrohydrochloric, nitric, and hot sulphur acids.

It is very commonly contaminated with lead, iron, and copper, together with traces of arsenic, antimony, and tellurium.

In the metallic form bismuth is not used in medicine, but its salts, particularly if free from contamination, are of great value.

The garlicky odor sometimes produced in the breath of patients taking the salts of bismuth is due to the presence of the metal tellurium. This fact was first noticed by Sir James Simpson, and was established further in 1875, when specimens of bismuth containing tellurium as an impurity invariably produced in the breath the peculiar odor referred to.

The salts of bismuth are numerous, but only the most efficient will be mentioned, together with dosage.

Dose. — The subcarbonate is a white, tasteless powder soluble in dilute nitric acid with effervescence. Dose, 5 to 20 grains.

The subnitrate occurs as a white microcrystalline powder soluble in acids. Dose, 5 to 20 grains.

Bismuth citrate is a white amorphous powder, odorless and tasteless, and soluble in solutions of the alkali citrates. Dose, 1 to 5 grains.

The benzoate is a white, tasteless powder soluble in mineral acids. It contains 27 per cent. of benzoic acid. Dose, 5 to 15 grains.

Bismuth betanaphtholate occurs as a light-brown, insoluble, odorless powder. Dose, 15 to 30 grains.

The salicylate of bismuth is a white, bulky microcrystalline powder soluble in acids and alkalies. Dose, 5 to 20 grains.

The subgallate is well known under the name of dermatol (*q. v.*). It is without odor, non-irritant, and non-poisonous. Dose, 5 to 20 grains.

Physiological Action.—When applied to excoriated or ulcerated surfaces the salts of bismuth, for the most part, exert an astringent and sedative action. The claims that some of the salts of bismuth possess antiseptic properties — the organic compounds—have been substantiated by experimentation and practical observation: salicylate, benzoate, and betanaphtholate.

> Contrary to the observations of Morax and von Pfungen, bismuth in large doses possesses the property of decreasing notably the amount of sulphuric acid in combination among those subjects whose food consisted chiefly of albuminoid substances; indican is decreased and at times it disappears. The action of bismuth is poorly understood; these facts show that intestinal putrefactions diminish decidedly, despite that checking of intestinal peristalsis which bismuth effects. Devoto (Semaine Méd., No. 54, '94).
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> Bismuth naphtholate (bismuth oxide, 80 per cent., and betanaphthol, 20 per cent.) decidedly antiseptic. The drug is partly decomposed in the stomach, but the process is completed in the small intestine. R. W. Wilcox (Med. News, July 31, '97).
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> Bismuth preparations act, not only mechanically on catarrhal and ulcerative conditions of the mucous membrane of the stomach and intestines, but also chemically, as antiseptics. Bismuth and its preparations, particularly bismuth protoxide, has a marked catalytic power, and is capable of diminishing the proteid putrefactive processes in the intestinal tract. Bismuth subnitrate is reduced in the intestine by the action of the intestinal juices to bismuth protoxide, which, in part, explains its beneficial action. B. Laquer (Archives de Méd. des Enfants, No. 6, p. 340, 1903).

The action of the salts of bismuth when taken internally in therapeutic doses is much the same as when applied locally.

> The salicylate of bismuth causes a slight increase in the elimination of sul-

phuric ether by the urine. This elimination is somewhat diminished two or three days after the administration of the drug. Rovighi (Monat. f. prakt. Wasserheil., p. 372, '93).

The subnitrate is a powerful bactericide. It is to this action that it owes those virtues which have been for a long time universally appreciated in gastro-intestinal diseases that are the result of morbid fermentation, and in urethritis. It also owes its efficaciousness to the independent action of its oxide and its acid. The oxide has the property of saturating the acid supersecretions of the stomach; the acid has the same qualities and undergoes slow chemical changes in the intestine. From the time it comes in contact with these digestive regions the subnitrate meets with hydrosulphurous emanations, which, although transforming it into the black sulphide, set a corresponding proportion of nitric acid free. Because of its own acidity, the nitric acid acts directly on the intestinal mucous membrane as an astringent; but to this topical action its special antiseptic virtues may be added, for, according to Duclaux, the presence of a trace of nitric acid in an organic solution arrests the evolution of a great number of microbes and hastens their destruction. Meanwhile its bactericidal action does not cease here; from the time that it comes in contact in its intestinal course with fresh hydrosulphurous vapors it is reduced and transformed into nitrous vapors, the special antiseptic action of which, in regard to the bacteria which secrete putrid gases, has been shown by Girard and Pabst.

The use of the organic in place of the inorganic bismuth should be insisted on. The compounds of bismuth with beta-naphthol, phenol, tribromphenol, and tetraiodophenolphthalein are remedies which produce practical intestinal antisepsis. They are indicated in all gastro-intestinal fermentations and catarrhs until the symptoms are relieved, the dose to be determined by the severity of the symptoms. They are non-toxic and do not give rise to untoward symptoms. Wilcox (Med. News, July 31, '97).

Bismuth is poisonous when introduced under the skin. It should not, therefore, be employed subcutaneously under any circumstance.

Poisoning. — Poisoning may occur either from local application of bismuth preparations, from internal administration, or from subcutaneous injection.

A number of cases of poisoning recorded, produced by the absorption of insoluble preparations of bismuth when used as surgical applications, in which there was acute stomatitis, a blackened, ulcerated mucous membrane, followed by intestinal catarrh with pain and diarrhœa, and in severe cases by a true nephritis. Kocher (Volkmann's Samm. klin. Vort., No. 224, '87).

Case of poisoning by bismuth. A young woman had a large burn on the back, which was powdered with subnitrate of bismuth. A dark line appeared on the lips, with headache, nausea, vomiting, fever, and quick pulse, and the urine contained a small quantity of albumin. Neither lead nor arsenic was found by analysis in the bismuth employed. N. L. Wilson (N. Y. Med. Jour., Jan. 20, '94).

In the early studies of bismuth the effects of acute poisoning by the subnitrate of bismuth were alone observed. More recently, however, injecting into dogs repeated doses of the compound at intervals of several days or hours has given results closely allied to those observed in the human being by Kocher and Petersen, save that death followed in the train of these signs, which were, by reason of the large-size dose, very severe. Ulcerations replaced the aphthous patches, the liver was found congested, and the coats of the large intestine blackened. These changes come on

in strong, healthy dogs weighing from fourteen and one-half to fifteen kilogrammes (twenty-nine to thirty-five pounds). (Dalché and Villejean.)

The distinction which is to be drawn between a stomatitis resulting from the prolonged use of bismuth and that which is commonly seen after continued doses of mercury consists in a lesser degree of ptyalism. While the color of the spot usually becomes black if caused by bismuth, it seldom becomes so dark in hue under the influence of mercury. The changes in the vascular system, which are caused by bismuth in chronic poisoning, consist in the dilatation of the blood-vessels, with consequent relaxation and congestion of the part.

Case of a patient who had been attacked three times by a scarlatiniform erythema, followed by desquamation in patches, in consequence of having taken 30 grains of bismuth subnitrate that had been prescribed after an attack of diarrhœa. Amédée Dubreuihl (Bull. Gén. de Thér., p. 229, '97).

Twins, 3 weeks old, given Squibb's subnitrate of bismuth in the dose of 7 ½ grains every two hours, increased to 15 grains each every two hours. Soon the bismuth passed from the bowels uncolored. The breath took a strong, garlicky odor, so much so that the mother remarked about the peculiar odor. The infants then slowly changed to a dark color, as if asphyxiated. Infants sleepy. Drug almost wholly withdrawn; the cyanosis disappeared from both children as rapidly as it had come. A. S. Maxson (Annals of Gynec. and Ped., July, '97).

Two cases in which, as the result of extensive burns upon the arm, bismuth dressings were applied, causing bluish discoloration, swelling, and superficial ulcers of the gums. These were only controlled when the bismuth still adhering to the granulations was scraped off. Muehlig (Münchener med. Woch., Apr. 9, 1901).

Treatment of Poisoning. — The stomach should be evacuated and the freshly prepared sesquioxide of iron administered as the antidote to arsenic which is commonly combined with the native bismuth. Demulcents should be freely exhibited, and stimulants as the case may require. Following the administration of the soluble salts of bismuth accumulation in the liver may occur; but this is not likely to follow the use of the insoluble preparations.

Therapeutics.

Locally.—Many of the bismuth salts are useful when applied locally. The subnitrate of bismuth is a neglected remedy for external use. It has been found very useful in acute and chronic moist eczemas, as well as in intertrigo and excoriations in the region of the anus and genitalia in children. In fissured nipples, herpes zoster, ulcers, and in affections of the mucous membranes it has also proved serviceable.

Of the many bismuth preparations, but one may be substituted for iodoform, namely: bismuth salicylate.

In the first period of the chancroid and in tubercular ulcerations of the skin, if the salicylate of bismuth is dusted once a day on the diseased area, after a few applications the granulations become florid and the lesions show a marked tendency toward cicatrization. R. Brindisi (Ther. Gaz., Mar. 15, '95).

Dyspepsia. — Many of the bismuth preparations have decided value in the treatment of gastro-intestinal disorders.

Bismuth tribromophenolate useful in cases of gastric fermentation. Toxic symptoms never observed, although administered in doses ranging from 90 to 120 grains daily. Harmlessness attributed to a slow decomposition and the setting free of phenol. R. W. Wilcox (Med. News, July 31, '97).

Bismuth salicylate is inferior to bismuth subnitrate. The former drug precipitates the albuminoid ferments, and, therefore, it has an unfavorable action

in gastric affections. Bismuth salicylate acts by virtue of the salicylic acid that it contains, and, on that account, dyspepsia, renal affections, old age, atheroma, pregnancy, and nervous diseases, in which salicylic acid is contra-indicated, also contra-indicate this salt. Thabius (Gaz. Hebdom. de Méd. et de Chir., Dec. 31, '99).

Dyspepsia attended with hyperacidity, irritable stomach, and gastric carcinoma are often happily influenced by the administration of bismuth.

For such the following may be used:—

℞ Subnitrate of bismuth,
Carbonate of magnesia, of each, 5 grains.
Morphine sulphate, $^1/_{12}$ grain.
M. For one powder.

Gastric Ulcer. — This disorder is benefited by 10- or 15-grain doses of the subnitrate or benzoate three or four times daily. The addition of a small quantity of morphine markedly increases the analgesic action.

Chloroform-water with bismuth (water, 150; bismuth, 3; chloroform, 1) very valuable in chronic gastric ulcer. Its beneficial effects are due to its antiseptic, astringent, and hæmostatic properties. It also exerts a stimulant effect locally, healing the ulcer. Stepp (Ther. Monats., Nov., '93).

Fleiner's method of treating irritative diseases of the stomach with large doses of bismuth very successful, especially in lessening pain. Massive doses are of use especially in gastric ulcer. Matthes (Centralb. f. klin. Med., Jan. 6, '94).

In cases of gastric ulcer excellent results obtained by giving large doses of bismuth by the mouth in cases where the ordinary doses had not proved successful. Doses of 30 to 40 or even 50 grains of bismuth subnitrate were given three times a day suspended in water. Under these pain was rapidly relieved, vomiting ceased, digestion improved, allowing light nitrogenous food, such as fish or fowl, to be given, and the ulcer quickly healed. In acid dyspepsia it rapidly relieved the symptoms. In neurasthenic conditions, with symptoms resembling those of gastric ulcer, it also was of great service. Two cases of gastric ulcer, which were not relieved by large doses of bismuth given by the mouth, were cured by injecting the bismuth into the stomach after lavage. Dreschfeld (Brit. Med. Jour., Mar. 12, '98).

Diarrhœa. — Acute or chronic diarrhœas are often relieved by bismuth.

A dose of castor-oil in advance of bismuth subnitrate is of value in removing any possible cause of irritation. (Ringer.)

In severe diarrhœa in children it is best never to commence with a dose of less than 5 or 8 grains, and it is possible to dispense entirely with opium in many instances. Its beneficial action is undoubtedly due as much to the antiseptic power of the salicylic acid as to the astringent property of the bismuth. (Hale.)

It can best be administered to children in a mixture with glycerin and water, to be shaken before taken. The form of powder should be avoided, as liable to produce irritation of the gastro-intestinal mucous membrane. (Ehring.)

Naphthol is the remedy most frequently employed to procure intestinal antisepsis, but the burning taste sometimes renders its use impossible, particularly in children, and it is customary to combine it with a bismuth salt. Much more advantageous to use instead naphtholate of bismuth, or betanaphthol-bismuth, which decomposes in the intestine into naphthol and bismuth. Chaumier (Rev. Gén. de Clin. et de Thér., Sept. 21, '95).

In a very severe case of intestinal putrefaction bismuth naphtholate found to give great relief, limiting the tympanites, removing the offensive odor, and improving nutrition. R. W. Wilcox (Med. News, July 31, '97).

Typhoid Fever.—Bismuth betanaphtholate is a very efficient agent in the diarrhœa of this disease, especially in intestinal hæmorrhage, giving the drug

freely by the mouth as soon as the first bloody stool is observed. From 2 1/2 to 3 ounces may be administered in twenty-four hours, in doses of 2 1/2 drachms, either in lactic-acid lemonade, diluted milk, or cachets; 1 ounce may be given to a child of 12 years, in quince-syrup or boiled milk. (Letulle.)

Bismuth subiodide and salol seem to diminish tympanites, control diarrhœa, and prevent hæmorrhage. The two drugs administered alternately. Twenty-six cases successfully treated. Farrar (Med. News, Jan. 16, '92).

Vomiting.—Many cases of vomiting, even that of pregnancy, will usually yield to the administration of 20-grain doses of one or other of the bismuth salts. It is not always tolerated by the stomach, however, that of infants especially. This drawback may be oviated by combining it with an aromatic powder or magnesia.

BLACK TONGUE. See Tongue, Diseases of.

BLACK-WATER FEVER. See Malaria.

BLADDER. See Cystitis; Urinary System, Diseases of; Urinary System, Surgical Diseases of.

BLADDER, WOUNDS OF. See Abdominal Injuries, Bladder.

BLEPHARITIS AND BLEPHARADENITIS.

Definition. — Blepharitis can best be defined as an inflammation of the Meibomian, or sebaceous, glands of the hair-follicles, and, secondarily, of the follicles themselves. It may occur as a symptom of some form of reflex irritation from refraction errors, or may accompany conjunctival irritations, stricture of the tear-duct, and inflammations of all sorts.

Symptoms. — Slight localized swelling at the edge of the lid is the first manifestation of the disease. This gradually spreads until the entire edge of the upper lid is involved. Crusts then appear around the bases of the cilia of the swollen part and, the secretions being infectious, gradual extension to the lower lid follows. Some of the cilia in the inflamed follicles become loosened, and may easily be withdrawn without causing pain, or they may fall out imbedded in the crusts. Chronic conjunctivitis, phlyctenular conjunctivitis, and trachoma frequently occur as concomitants or complications.

Etiology. — Blepharitis is more common in strumous persons. It frequently presents itself as a result of excessive use of the eyes in reading, etc. Apart from the parasitic and traumatic varieties of blepharitis, it is usually of reflex origin, due to uncorrected refraction errors. As a rule, blepharitis ciliaris may be regarded as a sort of optical barometer or as an expression of the amount of functional strain; this is made manifest by a more or less intense variety of blepharitis or blepharadenitis (chronic blepharitis), and in my experience usually accompanies errors of refraction *other than myopia*. So-called "styes"—hordeola—accompany blepharitis, and, with retention-cysts and tarsal tumors, are the result of blepharadenitis or chronic blepharitis, with stenosis or stricture of the excretory ducts and abscesses of the Meibomian glands as a sequence. The varieties are:—

1. Blepharitis ciliaris: acute, simple; caused by reflex refraction error.

2. Blepharitis ciliaris: marginal and ulcerative, acute or chronic, conjunctival, trachomatous, diphtheritic, stricture of lacrymal duct, etc.

3. Blepharitis ciliaris: eczematous, squamous, exudative, pedicular.

4. Blepharitis ciliaris: furunculous, infectious, autoinfectious.

5. Blepharitis ciliaris: exanthematous, erysipelatous, phlegmonous, traumatic.

6. Blepharitis ciliaris: blepharadenitis, chronic Meibomian and follicular inflammation and obstruction.

Pathology.—If the crusts are washed off and the base of the lashes are magnified and carefully examined, it will be seen that the mouths of the follicles no longer closely surround the cilia. The latter are thus loosened. In more advanced cases the follicles are destroyed by the inflammatory process and the lashes are no longer reproduced, the seat of their former implantation becoming bare cicatricial tissue. The loss of the protection afforded the eye from light and the mucous surfaces of the lid by the cilia increases the sources of irritation and inflammation; involvement of the lacrymal puncta may then give rise to lacrymation and eversion of the lid; conjunctival and corneal inflammations follow as formidable complications.

Prognosis.—Chronic congestion of the edge of the lids, with slight swelling, is a trivial condition which is promptly cured if judiciously treated. The ulcerative form is less easily mastered, and the complications that are likely to follow make it important that blepharitis receive attention in its early stages.

Treatment.—In the first and second varieties the crusts must be carefully soaked and mopped with a warm, alkaline solution in the hands of the patient until softened. They should not be forcibly removed. Pledgets of absorbent cotton should be used to sop or mop the crusts and not disturb the cilia, which are ever ready to drop out. This tedious soaking process seldom occupies less than half an hour. In softening the crusts the head should be held erect and the basin containing the solution held under the chin, otherwise the blood by gravity congests the tutamina and partially defeats our purpose. The pledget of wet cotton should be held between the thumb and forefinger only, of the hand on the side to be soaked. If the back of the hand be kept uppermost and the other three fingers extended, the solution will not run down the arm nor wet nor soil the patient.

Having thoroughly removed the crusts, carefully dry the margins of the lids. In fifteen minutes' time wipe dry the edges of the lids and remove the fresh fluid exudation, which, if allowed to remain, dries and forms new crusts, and under these conditions all local remedial applications are of little use. This treatment must be persisted in, and requires the utmost patience. The yellow ointment of Pagenstecher has stood the test of years, and when this ointment will not effect a "temporary" cure—I use the word *temporary* advisedly—we must have resort to saturated solutions of nitrate of silver or even the solid nitrate itself. If rubbing a tiny scrap of the unguentum hydrargyri oxidi flavi (1 grain to 1 drachm of vaselin) upon the well-washed and thoroughly dried edges of the eyelid and into the cilia does not effect a cure, we must have resort to the nitrate of silver, brushing a strong solution carefully upon the edges of the lids and around the cilia or actually cauterizing the ulcerated area around the openings through which the cilia project.

As we have said, it is but "temporarily cured." Unless the cause of a blepharitis be removed, it will return. We have treated the local condition and not removed the cause. This, in our experience, is due, in the majority of cases, to a refraction error (usually hyperopia), and is simply an expression of functional strain. A careful refraction worked out under full atropine mydriasis, or by the

rapid method when the patient is over 45 years of age, is the best treatment for the simple, acute, and ordinary forms of blepharitis or blepharadenitis that an experience of a quarter of a century now suggests.

The crusts are usually quite adherent, owing to their composition, partly to the sticky secretion of the Meibomian follicles, and partly to a varnish-like substance (serum) which exudes from the hair-follicles. A weak solution of bicarbonate of soda softens and detaches them.

Best results obtained with a solution consisting of hydrogen dioxide and water, equal parts. This accomplishes the desired result and does not pain the eye. It is to be applied with a bit of absorbent cotton, dipped into the dioxide solution and rubbed along the lashes. This should be kept up until the specific oxidizing effect is seen on the scales or crusts, as will be evidenced by the effervescence. The edges of the crusts will begin to separate. They are then to be dried with absorbent cotton.

There is a great advantage in using this remedy in children; it greatly lessens the pain of the treatment. It is also of special value where ointments of all kinds produce more or less irritation, and sometimes cause an aggravation of the symptoms. S. C. Ayres (Cincinnati Lancet-Clinic, Oct. 23, '97).

Large number of cases of blepharitis treated with picric acid always with good results. Picric acid is used in aqueous solution of strength 5, 8, and 16 parts per 1000, or corresponding strength made with equal parts of water and glycerin. The yellow coloration of the tissue which it causes is not a great inconvenience. It is very necessary before applying the picric-acid solution to the diseased surfaces to soften them well and clear away the crusts which cover the eyelids by means of a hot solution of boric acid or of ichthyol. The applications are renewed every second day. In glandular and ulcerous blepharitis, after having cleansed the ciliary border, opened the little pustules, and extracted the eyelashes most affected, the base of the ulcers are touched with a little pledget of lint soaked in picric-acid solution 10 to 1000; then, after two minutes, the whole of the edge of the eyelid is treated with a weaker solution. Fage (Lyon Méd., Jan. 9, '98).

A 50-per-cent. ointment of ichthyol may be applied directly to the mucous membrane as a cure for blepharitis. A. Peters and Darier (Amer. Medico-Surg. Bull., Sept. 10, '98).

During the past year formalin employed in all cases of blepharitis. A tooth-pick with a small cotton mop wrapped on the tip so that it does not take up enough solution to run into the conjunctiva is used. The solution is made of the strength of $^{2}/_{10}$ per cent. to 1 per cent., beginning with the weaker. It must be frequently renewed or prepared at the time of using, in order to insure uniformity of strength. The lid is drawn away from the eyeball. The mop dipped in the solution is rubbed gently along the margin among the lashes until all the scales and crusts are removed and until the surface of any little pustule is rubbed off. A little bland oil may be applied afterward, or the formalin may be used in the oil. The applications are made daily, if possible, by the physician's hands. Otherwise they may be made by the patient at his home. Correction of all refractive errors is of prime importance; likewise the improvement of local or general conditions which may predispose the margins of the lids to disease will invariably improve all cases and will cure many of them. H. Moulton (Jour. of Amer. Med. Assoc., Sept. 17, '98).

In all but the oldest cases the application of protargol after the manner recommended by Darier is capable of bringing about a rapid cure. The scrubbing with protargol not only loosens the crusts, but also insures the silver reaching the diseased tissues at the bottom of the hair follicles. When the disease is of very old standing, so that the roots of the hairs are already atrophied, the thickened edge of the lid is everted, and there is troublesome lac-

rymation, for which the sufferers seek relief in one clinic after another without finding cure. In such cases good results follow the application of compresses wetted with ichthyol during the night. The good effects, however, are partly lost on account of the very considerable pain which followed the application. The writer has tried another body, thigenol, which has almost all the astringent properties of ichthyol, but without its irritating effects and disagreeable odor. The new product is a synthetical body containing more sulphur than ichthyol. The lid margins are scrubbed carefully with protargol, and then a compress of pure thigenol put on at night. After about three weeks the cure is complete. Reumaux (La Clinique Ophthal., May 10, 1904).

Blepharitis ciliaris (eczematous) occurs as a concomitant of eczema, seborrhœa, and other skin affections, and as a complication of vaccinia, syphilis, and other infectious processes, or may be parasitic, and is to be treated according to the rules of therapy in dermatology. Pediculi palpebrarum looks like a lid with a double row of cilia and readily yields to applications of unguentum hydrargyri.

Blepharitis ciliaris (furunculous) is a variety peculiar to no local or reflex condition, but is caused, as a rule, by an infection. Such inflammations follow the usual course of furuncular inflammations and abscesses, and the secretion from the localized slough furnishes the typical "furuncle bacillus." For this reason alone the boils, or furuncles, not necessarily "styes," recur, and acute autoinfection through the mouths of the Meibomian follicles occur and recur, unless severe antiseptic precautions are rigidly enforced. Hot fomentations with boiled water, followed by drenchings with borated or weak sublimate solutions (1 to 3000) are best. When furunculous abscesses are evacuated spontaneously or by the knife, a focus of infection is established, and we must use dilute listerin, Dobell's solution, Seiler's solution (tablets), electrozone, or dioxide of hydrogen, until complete healing has taken place. Fomentations are best made while the patient reclines. Squares of "spongiopilin" or pledgets of absorbent cotton covered with "oil-silk" are most convenient. Following hot fomentations, the eye should be lightly covered and protected from draughts.

Loss of cilia caused by destruction of glands is seldom seen, but such loss of cilia robs the eye of its protection against light. Cilia generally grow again unless the edges of the lids are sclerosed and deformed with cicatrices from neglected ulcerations about the mouths of the hair-follicles.

Closure of the puncta lacrymalia is a most serious complication. All careful operators take great pains to cleanse the cilia, especially the superior ones in any case. It is unsafe to operate with blepharitis present, as the secretion would infect the wound.

In phlegmonous, or erysipelatous, blepharitis ciliaris with abscess of the upper lids, and in cases of ecchymosis or other swellings, these should be evacuated, the eyeball being cut into.

A fact worth noting is that blepharitis ciliaris is seldom found accompanying myopia.

If blepharitis ciliaris is a symptom of functional strain of reflex eye origin, headaches are seldom present. If, on the contrary, headaches are the one symptom, blepharitis, or blepharadenitis, is generally conspicuous by its absence.

If one eye be used more than the other, or if one eye be not used at all, more or less blepharitis ciliaris will likely indicate the amount of strain.

Blepharadenitis is only an aggravated subacute or chronic form of blepharitis

ciliaris, in which the mouths of the Meibomian follicles have become closed and the lining membrane of the glands has become subacutely or chronically inflamed. Retention-cysts and abscesses with pyogenic membranes secrete pus from granulating sacs and deform the lid.

Unless every particle of diseased gland with its pyogenic membrane be carefully removed, recurrence will take place, and injury to the tarsal cartilage will cause deformity. Epiphora, entropium, and ectropium will ensue, and with them what is best described as "wrinkled lid" will remain as a permanent source of trouble, and rub its irregular surfaces over a cornea doomed to destruction from irritation and ulceration.

We can recall the time spent years ago in fighting blepharitis and blepharadenitis until its true case was recognized and understood. At present, and in the light of modern ophthalmic surgery, we recognize in blepharitis, or blepharadenitis, only a symptom which in a general way promptly yields to treatment when we remove the cause. The elimination of the latter as promptly brings relief in other directions: not only by improving the vision, but also by curing life-long headaches and other neuroses.

Charles S. Turnbull,
Philadelphia.

BORACIC ACID. — Boracic, or boric, acid appears in the form of white, translucent or lustrous scales or needles, and is usually prepared by adding hydrochloric acid to a hot solution of borax (sodium borate); when comparatively fresh it exhales a faint odor of benzoin. It has a warm, acrid taste; acid reaction; and is freely soluble in alkaline media, in oils, and in chloroform; 1 to 3 in alcohol; 1 to 15 in boiling and about 1 to 25-50 in cold water. The solubility in cold water varies so greatly with different specimens as to seem unaccountable, but doubtless depends upon the source of the acid, the mode of its manufacture, and the resultant purity or impurity. In 1889 Catanis proposed to render the acid more soluble by mixing 120 parts with 10 of calcined magnesia and 750 of water, whereby a considerable proportion of the former is in solution in excess.

From the fact that boracic acid forms borates with most of the alkaloids, it has been advised that they be employed when the acidity of the drug is to be feared.

Preparations and Dose.—Boracic acid, 5 to 15 or 30 grains.

Borate of ammonium, 10 to 20 grains.

Borate of sodium (borax), 15 to 30 grains.

Borate of zinc, for external use only.

Physiological Action. — Boracic acid and all its salts are deemed more or less antiseptic, and the former has attained special repute because of its inexpensiveness, general harmlessness, and unirritating character. But purity is always a matter to be carefully considered, both as regards external and internal use. It is not so commonly employed as an internal medicament, perhaps, as the sodium salt, because of its somewhat pungent and acid taste, and partly because it is deemed less convenient to prescribe in aqueous mixtures. In excessively large doses, however, both it and the salts depress the spinal centres, and may produce progressive loss of voluntary and reflex activity without affecting nerve or muscle. Schiff is responsible for the statement that boracic acid, when locally applied to nerves, causes the part to lose the power of originating, but not of transmitting, im-

pulses; so that, if the galvanic current be applied to the part of the nerve which has been exposed to the drug, no muscular contractions result; but, if the poles be placed above this part, the distal muscles respond at once (Wood). Some persons, however, appear to be able to bear with impunity almost fabulous doses of the drug, which evidences that its exact physiological *status* is undetermined and chiefly a matter of speculation.

In doses of 30 to 60 grains often repeated, boracic acid is likely to induce nausea and vomiting, and, if persisted in (or even in large, single doses), to give rise to concatenation of symptoms indicating gastro-enteritis.

Bruswanger (von Renterghem and Laura) remarked diuresis with increased desire to urinate to follow doses of from 30 to 120 grains; he believes that the acid is eliminated through the kidneys as an alkaline borate, in which conclusion Rabuteau concurs. Polli, however, does not believe that the acid undergoes any alteration, but that it is passed unchanged. H. C. Wood states that it is rapidly eliminated with the urine, and also escapes with the perspiration, saliva, and fæces. It increases elimination of urea, as well as the flow of urine.

Untoward Effects. — Though Gaucher insists that it would require 2 1/2 ounces, per day, administered for several days in succession, to produce dangerous symptoms, his confidence is not supported by general evidence, for it has been known, in considerably smaller doses, to induce parenchymatous nephritis. This is especially true of its sodium salt, which is a dangerous remedy as regards most renal maladies, and seems to possess the power of provoking malignant degeneration where a morbid process has already been set up in the kidneys. George T. Welch reports two cases in which the application of tampons of powdered boracic acid produced general toxic symptoms: in one case the skin had a dried, "charred" appearance, and in the other there was collapse; in both there was very marked coolness of the vagina. Mododewkow chronicles a death from washing the stomach with a 2 1/2-per-cent. solution; but there are no valid grounds for believing the medicament had anything to do with the fatality. Lemoine observed a bluish-gray line on the gums, as if from lead poisoning, in a case of epilepsy to which sodium borate had been given. Branthomme also reports two cases suffering with carbuncle who were poisoned through the daily application of 30 grains of the acid. The symptoms had no relation to the malady, for in the one case was restlessness and a feeling of burning under the whole skin, intense thirst, a temperature of 38.8° C., and the body covered with red patches; in the second case an eczematous eruption, anorexia, and insomnia appeared. In both cases the untoward symptoms subsided immediately on withdrawal of the acid applications. What is said of the acid will, in a general way, apply to its salts.

> Two cases of profuse dermatitis followed the administration of boracic acid. In the first case the condition developed on three separate occasions following the administration of the drug. The patient finally died some time after the last attack in uræmia following an alcoholic debauch. The manifestations in the second case were similar to those in the first in that they followed prolonged administration of boracic acid. Two forms of borax poisoning must be distinguished: one in which a large quantity of the drug is rapidly absorbed from the alimentary canal, from some serous or other cavity, or from an extensive raw

surface, causing vomiting and diarrhœa, general depression, skin-rashes, and partial paralysis of the nervous and muscular systems; occasionally death. The other class results from the administration of boracic acid or borax in comparatively small doses for long periods. In some of these cases the kidneys are diseased, in others albumin appears in the urine, and in several fatal cases uræmic symptoms were described. R. B. Wild (Lancet, Jan. 7, '99).

Fifth case of boric acid poisoning thus far announced in the literature. The patient presented a suppurative inguinal adenitis, otitis media, and mastoiditis. The inguinal glands were excised and the cavity packed with about 6 ounces of boric acid powder. Soon after the operation the man developed the typical signs of boric acid poisoning: profuse vomiting; a papular rash over the face, neck, and chest; and a weak, irregular pulse. The onset was rapid and the fatal issue came on within four days. There was also delirium and slight rise of temperature. C. I. Best (Jour. Amer. Med. Assoc., Sept. 17, 1904).

Therapeutics. — The scope of boracic acid as an antiseptic is very wide, for it has been employed in almost every conceivable surgical process: as a detergent for painful and suppurating wounds and ulcers; as a basis for injections and ointments of all kinds; in collyria; as an insufflation powder for the ear; to wash out irritable bladders and dilated stomachs; as an application to skin maladies.

The use of borax or boric acid as a preservative in butter and cream in the quantities specified in the recommendations of the English Commission is justified both by practical results and by scientific experimentation. The dusting of the surfaces of hams and bacon which are to be transported long distances with borax or boric acid, not exceeding 1.5 per cent. of the weight of the meat, is effective, and not objectionable from a sanitary standpoint. Meat thus dusted with borax or boric acid does not become slimy, because the preservative thus used prevents the growth of aërobic, peptonizing micro-organisms. V. C. Vaughan and W. H. Veenboer (Amer. Medicine, March 15, 1902).

Boracic acid has been very extensively employed in the treatment of eye maladies. Bourgeois, of Rheims, recommends it for phlyctenular and granular conjunctivitis; Smith, of Chattanooga, as a wash for ophthalmia neonatorum; Dimissas introduces, every night, an ointment of boracic acid between the eyelids after operating for cataract; but Noyes declares the drug should be used with caution, and of a strength of not more than 1 per cent., since he has seen a diffuse keratitis develop from a 4-per-cent. solution.

It is probable, however, that, when untoward results accrue to the use of a 4-per-cent. solution in the eye, even after cataract extraction, such is due to the quality of the acid employed.

In measles, too, frequent bathing of the eyes, nose, and ears with warm boracic-acid solution is to be recommended as beneficial and comforting to the patient.

This drug has, also, been employed in the treatment of chancroid as a dusting-powder; as an injection, and also internally administered, in cystitis; in naso-pharyngeal catarrh, especially the troublesome form seldom seen except in children; in chronic constipation, by applying the dry powder direct to the rectal mucosa; in watery solution and in ointment form to the urethra for gonorrhœa; in the form of ointment to the pustules of variola to prevent pitting, etc.

In spite of the reputation accruing at one time, it is doubtful if any material benefit is ever derived from the use of this acid in any but the milder and less

stubborn varieties of skin disease. It may, however, prove a valuable adjunct to other treatment.

Similar procedures have been recommended by many authors. Gaucher, corroborated by Sevestre, Compy, and Cadet de Gassicourt, however, goes further, and declares that he has secured rapid recovery in eczema, and also in contagious impetigo, by employing it in glycerole of starch, 1 to 30; he insists that this combination offers all the good to be obtained from oil of cade without any of the disadvantages of the latter.

In the erysipelas of the newborn Lemaine lauds this drug above all others. He holds that the malady is derived from an attenuated puerperal septicæmia in the mother, and so directs the application of hot solutions of the acid, and subcutaneous injections of the same, cooled, twice daily.

Matigon, of Bordeaux; Mackenzie and Abbott, of London, as well as many others, express a decided preference for boracic acid, or for the tetraborate of sodium (this latter being merely a combination of boracic acid and borax), above all other medicaments for the purpose of preparing solutions intended to be used in the pleural cavity, especially after pneumotomy or aspiration.

In 1890 Edmund Andrews, of Chicago, published the results accruing to a series of experiments undertaken to determine the value of the acid as an antiseptic. He placed 2 drachms of fresh pork muscle in each of a series of bottles, and added different percentages up to complete saturation of acid solution. The result seemed to prove that even the strongest solution cannot inhibit the growth of mycelia, and further that no species of germs can thereby be entirely prevented from growing; that boracic acid only covers a raw surface with a moisture that is not distinctly antiseptic, but is nevertheless rather unfavorable to the growth of bacilli. Unfortunately for Dr. Andrews's conclusions, however, they are based upon incomplete experiments, and consequently imperfect data. As has before been remarked, the acids of commerce vary greatly according to source and mode of manufacture; consequently a series of experiments should have been made with different products. Moreover, the evidence is now overwhelmingly positive that a moderately pure boracic acid is antiseptic, though only in slight degree; but it commends itself to the medical man especially because it is practically odorless and innocuous.

Internally the acid appears to have been successfully employed in a variety of maladies. Gaucher administered from 7 to 20 grains daily to a number of patients suffering with pulmonary tuberculosis, and claims that both the local and general symptoms were improved, while the sputum lost its fœtid character; it had, however, no action upon the bacilli.

Tertschinsky gave boracic acid in 240 cases of enteric fever in doses of from 12 to 15 grains three or four times daily, with only 9 resulting fatalities. Keegan also successfully employed it in a considerable number of cases.

Ammonium Borate.

This may be prepared by dissolving 1 part of boracic acid in 3 parts of hot liquor ammonia of a specific gravity of 0.960, and cooling to crystallization. It appears as white or transparent eight-sided crystals, with strong ammoniacal odor; soluble in the ratio of 1 to 12 in cold water. It is employed both topically and internally in cystitis, and internally in renal diseases, where, in either case, there is an excess of acid or earthy phos-

phates. The value of the remedy, however, is doubtful, though in some few instances it appears to afford slight relief. It has been tried in epilepsy also, but with negative results.

Sodium Biborate; Sodium Borate; Borax.

This, the best known and most generally employed internally of all the borate salts, has for many centuries been alternately lauded and condemned by the medical profession, though it has always retained a *status* in domestic pharmacy and therapeutics. As found in the shops, it appears in colorless transparent monoclinic prisms, shining, odorless, and effervescent in dry air. It is soluble in half its weight of boiling water, 1 to 16 in cold water; insoluble in alcohol, but very soluble in glycerin and fats.

> The addition of a small amount of sugar greatly increases the solubility of borax; it will also rapidly liquefy a solution of gum arabic which has become gelatinous from the presence of borax. Editorial (Amer. Medico-Surgical Bulletin, Oct. 25, '97).

It also has a faint, sweetish taste and alkaline reaction; in solution it absorbs carbonic acid and dissolves fibrin, albumin, casein, and uric acid.

> As a general rule, sodium borate behaves like the alkalies, and, therefore, it should not be associated with the salts of the alkaloids. In mixtures of this kind the patient is likely to take most of the alkaloid in the last dose, with harmful effect. A. Dujardin (Union Méd. du Nord-est, Nov., '91).

Therapeutics. — As an application to mucous membranes, because of its mildly antiseptic and soothing effects, borax in solution is almost without a peer; many maladies make most happy recoveries under its use that with other remedies of more pronounced astringent or irritant character prove most vexatious. Especially is this true of some of the lesser diseases of the eye and nasopharynx, the milder forms of conjunctivitis, certain forms of rhinitis, ulcerative stomatitis, etc. Sodium borate in camphor-water secures a pleasant, harmless, and grateful collyrium that may advantageously be employed, either alone or in connection with other remedies, in most inflammatory conditions of the eyes.

> In ulcerative stomatitis, swab with water acidulated with a few drops of acetic acid and follow by painting with borax (1 part) dissolved in glycerin (8 parts). Garrigues (Med. News, Oct. 1, '92).
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> In atrophic rhinitis solution of sodium borate in glycerin, sufficiently diluted with water, may be sprayed into cavities; glycerin prevents formation of crusts; sodium borate prevents decomposition of exudation. Musehold (Revue Inter. de Méd. et de Chir., Apr. 25, '95).
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> There can be no doubt of the value of boracic acid and borax as local applications in aphthous ulcerations, diphtheria, and other inflammations of the mouth, in which the crystals of the sodium salt may be permitted to slowly dissolve on the tongue. H. C. Wood ("Therapeutics: its Principles and Practice," ninth ed.).
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> Sodium borate is frequently employed against stomatitis and against aphthous ulcerations of the mouth, as in ptyalism, glossitis, anginas, etc. It is evident that the antizymotic property of sodium borate is the deterring influence. Von Renterghem and Laura (Dosimetric Med. Review, Dec., '97).

The last authors quoted very justly believe that this medicament offers certain advantages in the treatment of some skin diseases, since it may be employed topically to dissolve the pellicles of the epidermis joined together by sebaceous matter, thereby acting as a detergent; in pruriginous or eczematous eruptions due to the accumulation of products of the sudoriparous glands the salt is often most effective.

Congenital ichthyosis in a child treated by washes of sodium borate. Sherwell (Jour. Cut. and Genito-Urin. Dis., Sept., '94).

In erysipelas Sevestre employs baths at 93.2° F. containing 16 ounces of sodium borate, which, he claims, lowers the temperature and tends to heal the eruption.

In 1894 Ciaglinski and Hewelki described a case of black tongue presenting a patch of mold extending as far back as the circumvallate papillæ that contained black pigment and closely resembled the fungus known as *Mucor rhizopodiformis*. By means of borax washes the tongue became clean in a couple of days.

Both borax and boracic acid have been recommended as injections for an inflamed bowel, but their utility cannot be very pronounced.

In severe cases of infantile diarrhœa daily irrigation of the larger bowel is most beneficial during the height of the disorder. I employ borax: 1 drachm to a pint of warm water. Carter (Provincial Med. Jour., May 1, '94).

That sodium borate has some action upon the central nervous system is apparent, but this is so ill understood that it is impossible to formulate any definite physiological basis for its internal administration. It has been empirically recommended for a multitude of diseases, including locomotor ataxia, paralysis agitans, cholera, etc.

Have used sodium borate with excellent results in paralysis agitans. Sacaze (Bull. de la Soc. de Méd. Mentale de Belgique, Mar., '94).

Borax in doses of 80 to 90 grains daily is to be highly recommended as a prophylactic against cholera. During the epidemic in Italy during 1864-65 none of the villagers employed in the borax works were affected, while in a village in close proximity one-third of the inhabitants died. I opine that the drug kills the germs in the alimentary canal. Cyon (Compt.-Rend. Acad. Sci., xcix, 149).

Looking at the drug from the standpoint of the author last quoted, and admitting its mildly antiseptic property, —which are undoubted,—it is easy to discover the reasoning that has led to its use in septic diseases. So, too, the solvent action of the borates as regards uric acid, and their tendency to eliminate urea, explain why borax often yields gratifying results when employed in uric-acid lithiasis; but it should always be most freely diluted with water. Another peculiarity of borax, also undefined, is its affinity for the genito-urinary organs. In some cases it relieves uterine hæmorrhage with surprising promptness: an action that can only be explained by reflex through the nervous system.

But it is in epilepsy that borax has been most exploited in recent years though its use in this direction is by no means new; and for a brief period it was thought an absolute panacea had been discovered. But H. C. Wood, who tried it in a number of cases, succeeded only in inducing marked gastro-intestinal irritation in every patient.

In order to avoid gastric and skin troubles by reason of large doses, I would suggest the borax be given with considerable doses of naphthol or bismuth salicylate. Féré (La Semaine Méd., Feb. 4, '92).

Of twenty-five cases one was cured and all relieved but six. Treatment was continued from one to seven months. Dijoud (Lancet, July 18, '92).

Borate of soda is superior to potassium bromide in symptomatic epilepsy, but of less value in nervous epilepsy. Mariet (Le Prog. Méd., Oct. 10, '92).

The prolonged exhibition of the salt may induce cutaneous troubles, consisting principally of seborrhœic eczema of the scalp. The hair is shed, but grows again when the administration of the

borax is stopped. Féré (Lancet, Dec. 23, '92).

Borax as a means of relief seems to have established for itself a fixed and permanent position. Gray, Pritchard, and Shultz (Annual of the Univ. Med. Sci., vol. ii, '94).

Borax is a useful remedy against convulsive attacks of an epileptic character. Angelucci and Pieraccini (Lo Sperimentale, No. 1, '94).

Borax given alone is disappointing in some respects, but given with the bromides its action is much better and the combination superior to either drug alone. Alexander (Liverpool Medico-Chir. Jour., July, '94).

On the whole, borax is of no value in epilepsy. Lui and Guicciardi (Revista Speri. di Fren. e di Med. Legale, etc., Sept., '95).

It may be imagined that under certain circumstances borism may give rise to accidents every whit as grave as those of bromism, with the difference that those arising in the kidneys are more insidious and more difficult to remove. This fact, more than all else, perhaps, has led to a very general abandonment of the drug, though a few still persist in its use, with more or less varying results that apparently depend upon the tolerance exhibited by the individual patient.

Tetraborate of Sodium.—Boymond, in 1893, called the attention of the Société de Thérapeutique to a new product which he termed "boro-borax," and for which was likewise claimed antiseptic properties superior to those of corrosive sublimate. This is simply the tetraborate of sodium in solution, and appears to be a trifle more powerful than a corresponding solution of boracic acid. A solution may be extemporaneously made by adding 26 drachms of boracic acid to a quart of distilled water and then neutralizing by sodium borate.

Zinc Borate, or Tetraborate.

This is an amorphous, white powder obtained by the interaction of zinc sulphate and sodium borate in hot water. Like all new agents of its class, when first introduced wonderful antiseptic power was claimed for it, but this appears to have not been sustained. It is freely soluble in acid media only; has been employed as a dusting-powder for raw surfaces; but it does not appear to offer any advantages over boracic acid, while its almost insoluble character inhibits its use in conditions where the latter is always available.

BRAIN. See Cerebral Abscess, Cerebral Hæmorrhage, Encephalitis; Head, Injuries of, etc.

BREAST. See Mammary Gland.

BRIGHT'S DISEASE.

Acute Nephritis.

Definition. — An acute inflammation of the kidneys, and either of a mild, severe, or grave character. It may be more or less diffuse in nature. Three varieties of acute renal disease are described by Delafield under the term acute Bright's disease: (1) acute degeneration of the kidneys, (2) acute exudative nephritis, and (3) acute productive nephritis.

Symptoms.—The onset is sudden, as a rule, but varies with the exciting cause of the nephritis. Chilliness, nausea and vomiting, pain in the back, and, within twenty-four hours, dropsy are seen in some cases. Children are subject to convulsions (uræmic), and in severe cases adults are no less liable. Fever may be present, but it is neither constant nor high. The early appearance of œdematous puffiness of the eyelids and face, and of pallor of the skin, is characteristic. Soon, and sometimes at first, a swelling occurs about the ankles and

legs, and in severe cases dropsy involves the whole body. The scrotum, penis, or labia may, in such cases, become enormously distended, the skin presenting an almost translucent appearance.

Often local symptoms are absent, as pain and tenderness in the lumbar region; they are never marked. Micturition may be frequent and accompanied by a slight burning and vesical tenesmus, due to the concentrated urine. In very severe dropsy the tense, dry skin may become sensitive or even painful on pressure. Bodily movements are often painful and difficult in cases of marked anasarca. Uræmia may be heralded by intense headache and backache.

A urinary examination is always necessary, as in mild cases the renal condition may be overlooked. There may be no further symptoms than a general malaise.

The urine in acute nephritis furnishes distinctive characteristics. The total quantity passed in twenty-four hours is diminished, and may even be very scanty, varying from 5 to 25 ounces (150 to 740 cubic centimetres). There may be suppression in cases of toxic origin, when an acute degeneration or necrosis of the renal epithelium occurs, and in the very severe exudative inflammations.

The specific gravity is early increased to 1025 or more, though later it may fall to 1015 or 1010. The color is darker than normally and is usually smoky red, or reddish brown, according to the amount of blood contained. A more or less abundant flocculent sediment appears on standing, if the normal morphological constituents are present in great quantity.

Some red blood-corpuscles and renal epithelium are found microscopically, together with the characteristic hyaline, blood, and epithelial tube-casts. The urine is acid in reaction, and on boiling throws down a thick, curdy precipitate of albumin, which varies in weight from $^1/_4$ to 1 per cent. The urea is diminished.

There may also be other symptoms during the course of acute Bright's disease, as those of hydrothorax, ascites, and hydropericardium, in cases in which great general œdema is present. The first-named condition is bilateral and gives rise to dyspnœa; the second increases the dyspnœa by pressing the diaphragm upward; and the last impedes the heart's action. Strümpell describes a form of pneumonia that sometimes develops in severe cases of acute nephritis,—a "stiff inflammatory œdema,"—midway between lobar and broncho- pneumonia. There may also be œdema of the conjunctivæ, soft palate, and larynx.

The pulse is often hard and tense, and, though slow at first, it may become accelerated later. Cardiac hypertrophy may be present in a slight degree. The aortic second sound is accentuated. Epistaxis appears occasionally, and subconjunctival hæmorrhages sometimes follow unwitnessed uræmic convulsions. Dryness and uræmia of the skin form a constant condition. Uræmic manifestations may supervene at any period in the disease, appearing early in the most severe cases, with intense headache and backache, vomiting, and convulsions.

The above may be considered a description of the common form of acute nephritis resulting from exposure; the clinical course differs somewhat in other cases. Occurring as a complication of the infectious fevers, except scarlatina, acute nephritis may be characterized by the very slight degree, or even by the absence, of dropsy. Albuminuria, hæm-

aturia, anæmia, and uræmia mark the graver affections. In scarlatinal nephritis, however, anasarca is common, and a slight œdema, at least, is quite constant. Mild affections show simply a slight quantity of albumin and a few hyaline casts, indicative of the parenchymatous degeneration. The typhoid state may follow the subsidence of the acute toxic symptoms in cases of degenerative nephritis due to mineral poisoning; this is marked by prostration, muscular twitchings, stupor, coma, and death. Hæmaturia may be pronounced in the so-called nephro-typhoid condition, in which typhoid fever begins with marked symptoms of acute nephritis. The nephritis of pregnancy, as a rule, is gradual in its onset. The albumin increases in quantity from month to month, reaching a high percentage during the eighth and ninth. Some hyaline casts are found; but otherwise there are few morphological elements. Red blood-corpuscles rarely may be seen in the urine. Up to the time of delivery the danger of eclampsia is constant, but recovery is rapid in uncomplicated cases after the birth of the child.

In acute (productive) nephritis, where there is a tendency to the formation of patches or wedges of fibrous tissue, there is a higher fever, there are cerebral and circulatory disturbances of a typhoid nature, as well as anæmia, dropsy, and a highly albuminous urine, even though there be no blood-corpuscles and few casts. Dropsy is most marked in the legs. There are a progressive and rapid loss of flesh and strength, dyspnœa, vomiting, diarrhœa, and convulsions or coma and end in death. Milder cases last from two to four weeks, and apparently recover; albumin and casts persist, however, until another and a similar attack occurs after an interval of weeks or months. Thus, the first acute attack is subject to chronic recurrence, until a fatal seizure takes place.

Etiology.—Acute nephritis more often appears before than after the middle time of life, though it may occur at any time. Males are more often attacked than females.

> Analysis of 270 cases of Bright's disease. Nephritis occurred more frequently in males than in females (3.309 to 2.74); most common during the period of greatest activity of the body. Of the 270 cases, 140 were acute, 85 being hæmorrhagic. Of these 140 cases of acute Bright's disease, 70 per cent. could be traced to acute infectious diseases, only 2.85 per cent. being directly traceable to cold. Agnes Bluhm (Deutsches Archiv f. klin. Med., B. 17, H. 3, 4).
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> Of 251 cases of chronic nephritis observed by Heubner in Leipzig, 214 occurred in adults and 37 in children. He subsequently saw 28 cases in children in Berlin, mostly after scarlet fever. Of these 65 cases, there were 3 of parenchymatous nephritis, 4 of contracted kidney, and 5 of chronic hæmorrhagic nephritis. Brill and Libman (Jour. of Exper. Med., Sept. and Nov., '99).

Occupations necessitating exposure to cold and wet offer special predisposing conditions. The long-continued use of alcohol will also, as a rule, prove a predisposing cause of acute Bright's disease.

Among the exciting causes of acute diffuse nephritis are:—

1. Those acting on the skin, as cold, dampness, extensive burns, and chronic skin diseases. It is often difficult to determine the relative influence of alcoholic excesses and the exposure incident thereto. Acute intoxication from beer-drinking may result in an acute nephritis, but it is yet likely that in most cases the exciting cause is the cold acting upon the individual in his exposed and maudlin condition. Acute nephritis may also be caused, at times, by exposure

to cold and wet apart from and in the absence of alcoholic indulgence; in such cases it is to be presumed that there is an inherent weakness of the kidneys, or a susceptibility rendering these organs the vulnerable point in the system.

The physiological toxic agents embrace the poisons of the acute infections; in a majority of cases, however, scarlet fever is the primary affection. Usually the nephritis appears during the second or third week of convalescence, though it may supervene at the height of the disease.

Among 97 cases of scarlet fever, but 4 exhibited the symptoms of Bright's disease. Of 45 cases of measles but 1 evinced renal involvement. In 162 cases of erysipelas, Bright's disease occurred 7 times and simple albuminuria 17 times. Among 481 cases of variola it appeared but once: in a child 12 months old. In 93 cases of diphtheria it occurred but 4 times and simple albuminuria but 6 times. Of 74 cases of tonsillar angina, 4 cases presented evidence of nephritis and 20 were albuminuric. Among 10 cases of ulcerative endocarditis it occurred once. Out of 360 cases of acute rheumatism, but 4 were affected secondarily by acute Bright's disease. Acute nephritis is not rare in acute pneumonia, occurring in 26 out of 140 cases. Agnes Bluhm (Deutsche Archiv f. klin. Med., B. 17, H. 3, 4).

Very grave nephritis supervening in the first seven days of scarlet fever, thus differing from the late nephritis; to it must be ascribed the fatal termination sometimes noticed in the early stage of scarlet fever. Inflammation extending to the papilla constitutes the most essential characteristic; leads to retention of urine and dilatation of the canaliculi. Aufrecht (Rev. des Sci. Méd. en France et a l'Etranger, July 15, '94).

Renal disease is associated with insanity in two ways: (1) acute transient delirious mania, an acute toxæmia, or uræmic insanity, and (2) a progressive cerebral degeneration, with chronic renal disease as the primary cause. In this type the mental symptoms during the earlier stages vary from a mild dementia to mania or delirium. In due course, however, complete dementia results not unlike paralysis of the progressive type known as general paralysis of the insane.

In some cases the spinal symptoms become marked, and changes in the spinal cord are found after death.

The dyspnœic and gastro-intestinal forms of uræmia are sometimes seen in the insane, but it is with the comatose and convulsive types that asylum physicians have chiefly to do.

Out of 3000 cases admitted to Bethlem since the year 1888, 172 had albuminuria on admission (or 5.7 per cent.); of these 172, as many as 40 (or 23 per cent.) recovered from the mental attack; of the remaining 132, 37 died of general paralysis and 20 of senile dementia, and the remaining 75 became incurables. On careful analysis of the details of these 172 cases is to be noted the comparative frequency of such symptoms as inequalities of the pupils, tongue tremors, alterations and defects of speech, sluggishness or exaggeration of the knee-jerks, and not infrequently hemiplegias, or other symptoms of arterial and cerebral degeneration. The cases diagnosed as general paralysis appeared to have been of three types: (1) parasyphilitic types, which correspond most closely to the classical descriptions of general paralysis; (2) types of cerebral degeneration due mainly to vascular changes consequent upon kidney disease; and (3) types of associated mental and motor defects in which the kidney disease is merely coincidental, the mental and motor symptoms being due to other factors, such as sunstroke, malaria, post-febrile and toxic states. T. B. Hyslop (Practitioner, Nov., 1901).

Appendicular toxic nephritis is of extreme importance. The nephritis often escapes observation owing to the absence of obvious symptoms, more particularly in the event of the albumin being present in but moderate excess and where that most graphic symptom, the swelling in the region of the eyes, is absent. In these cases the urine should

be watched very carefully for granular casts, and, if they are discovered, the prognosis is rendered much more grave. Albuminuria in itself does not always justify us in giving an unfavorable prognosis, but it is nevertheless one of the signs of impending toxæmia, and should be regarded as an important danger signal. This is not due to the nephritis alone, which in some cases may lead to anuria and to general intoxication of the organism. It is interesting to note the possibility that the nephritis due to appendicular toxins may be a factor in the etiology of chronic nephritis, or, indeed, spreading farther, it may in cases of chronic appendicitis be a prominent factor in the etiology of general cirrhosis. Dieulafoy (Med. Press, Nov. 4, 1903).

2. Acute nephritis may also be the result of other of the infectious fevers (small-pox, typhus, typhoid, relapsing fever, cholera, diphtheria, yellow fever, measles, chicken-pox, erysipelas, septicopyæmia, acute lobar pneumonia, cerebrospinal meningitis, dysentery, acute articular rheumatism, and tuberculosis; syphilis is rarely a cause).

Occurrence of nephritis in secondary syphilis in a case investigated in Birch-Hirschfeld's laboratory. The patient died in coma. At autopsy the lungs, spleen, liver, lymphatic glands, and kidneys were all found to be the seat of more or less interstitial inflammation. The kidneys were large, and on section showed signs of subacute interstitial nephritis; the epithelium of the tubules, which were much compressed, was only slightly affected. These changes believed to have been due to syphilis. The nephritis could not have been of mercurial origin, for it would have been parenchymatous, and not interstitial. Doederlein (Münchener med. Woch., Oct. 13, '96).

Acute interstitial nephritis found in 42 cases of infectious diseases, most frequently in diphtheria and scarlet fever. The interstitial tissue in these cases is infiltrated diffusely and in foci by cells resembling the plasma-cells of Unna. No satisfactory explanation can be given for the almost constant tendency of the infiltrating cells to collect, especially in the boundary zone of the pyramids, the subcapsular region of the cortex, and around the glomeruli. W. T. Councilman (Jour. of Exper. Med., July and Sept., '98).

It may also supervene as a primary condition, and the brunt of the attack may be sustained either by the kidney, rather than by any other part, or by the organism as a whole, as in the fevers. Mannaberg has described such cases, and has demonstrated the presence of streptococci in the urine.

The tendency even now is to attribute too large a share to cold in the causation of nephritis. Taking the infective diseases alone, the alterations brought about by the micro-organisms in the renal tissue may pass without leaving any trace, but they may also become chronic, causing changes in the epithelial elements and interstitial proliferation. M. Vignerot (Arch. Gén. de Méd., Oct., '91).

Bright's disease, an infectious disorder in which the micro-organisms act upon the kidneys. (1) Hyperacute infectious Bright's disease; (2) acute infectious Bright's disease; and (3) attenuated infectious Bright's disease. Fiessinger (La Sem. Méd., May 12, '94).

Case of primary acute hæmorrhagic nephritis, in a man 42 years of age, coexistent with the presence in the urine of large quantities of the staphylococcus pyogenes albus. Baduel (Riforma Med., Aug. 7, '94).

Seventy cases showing causal relationship between ulceration of the duodenum and interstitial or tubal nephritis, or both combined. Perry and Shaw (Practitioner, Dec., '94).

Case in which nephritis was due to infection through skin wound. Sacaze (Revue de Méd., Feb., '95).

Case in which ulcer appeared as first symptom in case following a rapid course, showing at autopsy degeneration

of convoluted tubules with slight arteritis. Etienne (Le Bull. Méd., July 14, '95).

When toxic substance reaches kidney through nutritive artery it exerts an elective action upon the epithelial cells of convoluted tubules, with lesions of protoplasm, steatosis, and coagulation necrosis. Vandervelde (Jour. de Méd., de Chir., et de Pharm., vol. iv, No. 2, '95).

Case showing that absorption of alimentary ptomaines which kidneys cannot eliminate may give rise to lethal poisoning. Dieulafoy (Annual, '96).

Three cases of hæmorrhagic nephritis caused by infection of the blood with bacteria which otherwise did not produce evident symptoms. In the first case a general infection of the blood, the liver, the kidneys, and the spleen with streptococci was found at the autopsy; the disease had continued for eight months and presented, as its only symptom, hæmorrhagic nephritis; there was no fever except during the last two weeks of life. In the second case symptoms of endocarditis and of hæmorrhagic nephritis were combined; the blood contained intra vitam staphylococcus albus, and the same bacterium was found on the growths on the mitral valve. In the third case the examination of the urine revealed the presence of staphylococcus albus in great quantity. The author insists on the fact that a general infection of the organism with bacteria of different species may reveal itself only by the presence of hæmorrhagic nephritis, and he believes that the hæmorrhages which occasionally occur during the course of an ordinary nephritis may be caused by a temporary invasion of bacteria in the blood. Holst (Norsk Mag. f. Laegevidensk., p. 825, '99). Report of Corr. Ed. F. LEVISON.

3. Chemical toxic agents include turpentine, cantharides, carbolic and salicylic acids, potassium chlorate, iodoform, the mineral acids, and inorganic poisons, such as phosphorus, arsenic, mercury, and lead. Acute renal inflammation may be caused by the excessive ingestion of highly-acid, spiced, or adulterated foods (as from salicylic acid and lead chromate).

Large number of substances—cantharides, styrax, balsam of Peru, cubeb, turpentine, mustard- and croton- oils, naphthol, carbolic and oxalic acids, phosphorus, etc.—which act upon the kidney as poisons by causing acute diffuse nephritis. Lenzmann (Deutsche med.-Zeit., Aug. 6, '94).

Experiments with various toxics, and clinical facts show that the pathological process is a uniform one, the epithelium of the convoluted tubules, the epithelial cells of the straight tubules, the glomeruli, the interstitial tissue, and vascular walls being, in turn, involved. Burmeister (Virchow's Archiv, B. 137, H. 3).

Case of a man who, after taking potassium chlorate in the form of pastilles of 15 centigrammes each before meals (8 being taken daily) for the relief of angina, developed an acute hæmorrhagic nephritis. The author believes that the noxious influence of the drug was attributable to its ingestion in the fasting state, and in support of this idea quotes Mering's statement that the effect of potassium chlorate is always more deleterious when taken upon an empty stomach. A. Lorand (Jour. Méd. de Bruxelles, Mar. 5, 1903).

4. Pregnancy may act as a cause of acute nephritis (gravidarum). In such cases it usually appears in primiparæ, in the last months of gestation, and is probably the result of renal engorgement due both to mechanical pressure and to nutritive disturbances in the kidney, owing to the altered blood-condition.

5. Latent chronic nephritis may form the cause of a manifest acute nephritis.

Pathology.—There is a considerable variation in the anatomical changes in and the appearance of the kidneys, according to the degree of involvement. Between the very mild and grave cases there is an intermediate series of continuously more marked pathological

changes dependent upon the amount of poisonous material circulating in and eliminated by the kidneys, as well as upon the intensity and duration of its toxic action.

There may be no microscopical change in the mildest cases. As a rule, however, the kidneys are slightly enlarged, swelled, and somewhat softened, though these conditions are more evident when the interstitial exudation is abundant and inflammatory œdema is evident. On section the organs may appear red and congested or they may be pale and mottled. In the former case hæmorrhages may appear beneath the capsule (acute hæmorrhagic nephritis); it is more usual, however, to see red, hyperæmic patches alternating with opaque and whitish portions, both on the outer and the cut surfaces. Especially is the cortex swelled, turbid, and pale, or slightly congested in the mildest cases; in severe attacks it is deeply mottled (red and pale glomeruli) or hyperæmic. The surfaces are smooth and the capsule non-adherent. The pyramids usually show an intense-red color.

In the very mild cases, already referred to, changes may be noted microscopically that are not visible to the naked eye, there being simply a cloudy swelling or a granular (parenchymatous) degeneration of the epithelium of the Malpighian tufts, Bowman's capsule, and of the uriniferous tubules of the cortex. In the absence of exudative changes in the interstitial tissue, however, this cannot be called true acute nephritis. The acute parenchymatous degeneration may be limited almost exclusively to the glomeruli, as in some cases of scarlatina, and from this fact has arisen the term "glomerulonephritis." The muscles are either swollen or absent; the cells are swollen, opaque, and irregular in shape; and the cell-contents are granular (albuminoid or fatty). The death of the cells—owing to coagulation necrosis or disintegration, desquamation, and hyaline degeneration of masses of the cells in the tubules—marks a further stage in the process. Acute degenerative changes are frequently found in the acute infectious diseases, or when inorganic poisons have been introduced into the body. In phosphoric poisoning there may be an actual fatty degeneration of the epithelium, either proceeding from the cloudy swelling or occurring as an independent development. In severe cases a rapid necrosis of the cells is also met with.

True acute nephritis exhibits not only changes in the parenchyma (epithelium), but also an inflammatory exudate between the tubules, consisting of serum, leucocytes, and red blood-corpuscles. In some places the kidneys show only a slight cellular infiltration of the intertubular tissues. In others the interstitial tissue is swelled by the coagulated serofibrinous exudate, many leucocytes, and some erythrocytes, besides the desquamation of necrotic epithelial cells and the presence of hyaline casts in the tubules. The inflammatory exudate collects, also, in the Malpighian bodies and tubules. The tubules may be dilated and choked with degenerated cells, or more frequently the straight tubules are clogged with hyaline casts. The lining epithelium, especially in the convoluted portion of the tubules, is often flattened. The white blood-corpuscles infiltrating the stroma of the kidneys are collected in foci in the cortex, and not, as a rule, equally diffused.

The outlines of the individual capillaries are lost, and the glomerular epithelium of the capsule—especially that covering the inside of the capillaries of the tufts—is swelled and opaque. New

epithelium appears in most instances of diffuse exudative nephritis, and a restoration of the glomerular function occurs. According to Delafield, in the productive variety of acute diffuse nephritis, however, certain lesions are more permanent in character from the outset in the glomeruli and stroma, and hence the increased gravity of the disease. Superadded to the usual exudative condition are the following changes: (*a*) a growth of the cells lining the capsules, such as to form a mass that compresses the tuft, "and leading, finally, to obliteration of the vessels and fibroid glomeruli"; (*b*) a growth of the connective tissue parallel to, and surrounding, one or more arteries having thickened walls, and forming more or less numerous and regular strips or wedges in the cortex. The new tissue between the tubules is, in the more intensely acute cases, largely cellular; in those of a subacute type it is relatively dense and fibrous.

Pleural, pericardial, and peritoneal dropsy, as well as anasarca, are also found in those dying of acute Bright's disease. Meningitis, cerebral œdema, and lobar pneumonia are also sometimes seen post-mortem.

Diagnosis. — Acute Bright's disease can hardly be overlooked when the urine is carefully examined chemically and microscopically. The eclampsia of pregnancy can, however, be recognized only by repeated examination of the urine, especially during the last months of pregnancy.

> Case of subacute nephritis subsequent to an attack of simple herpetic tonsillitis. On the fifteenth day an eclamptic crisis suddenly set in, accompanied with anuria. Urine contained 1 ¼ drachms of albumin per quart. The crisis became more frequent, coma set in, and the patient died with broncho-pneumonia. Histological examination of the kidneys showed, on the tubular epithelia, an immediate lesion with cloudy tumefaction and coagulation necrosis. Siraud (Revue Inter. de Bibliographie, Apr. 25, '94).
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> Three cases of acute interstitial nephritis. The first was a case of general streptococcic infection after abortion; the second also followed abortion, but the kidneys were sterile; the third was due to streptococcic infection and occurred with broncho-pneumonia secondary to otitis media. Councilman in 1898 reported 42 cases, in which he found Unna's plasma-cells to be the most numerous cells of the renal exudate, lymphocytes and polynuclear leucocytes being also present in variable numbers. In the three cases plasma-cells and lymphocytes were present, but in each case there was, in addition, the eosinophilic leucocyte, a cell not hitherto described in nephritic exudations. W. T. Howard, Jr. (Amer. Jour. Med. Sci., Feb., 1901).

Acute Bright's disease should be suspected, and the urine examined, in every case showing pallor of the skin and puffy eyelids, whether general prostration of the health is apparent or not. The characteristic symptoms of acute exudative nephritis, as commonly seen when the condition is due to cold or occurs in scarlet fever, are the following: Headache, restlessness, muscular twitching, nausea and vomiting, a tense pulse, moderate fever, dropsy, and anæmia. Tube-casts and albuminuria are constant. It should be borne in mind that slight albuminuria occurring in the course of pregnancy or during any of the fevers, without casts, is not a true nephritis, although the latter may be a more or less remote consequence of the glandular degeneration of the renal epithelium associated with the febrile albuminuria. In addition to the presence of albumin and hyaline and cell- casts, however, a diminished quantity of sooty-looking urine and the discovery of red and white

blood-corpuscles will render the diagnosis positive. The history of the case and the causal factors are also to be taken into consideration.

Prognosis. — A case of ordinary exudative nephritis following exposure to cold and wet runs a course varying from a few days to three or more weeks. There is a steady diminution of the albuminuria, which finally disappears together with the casts, while the daily quantity of lighter urine and the daily excretion of urea increase. The character and intensity of the renal inflammation, and the primary disease or causative conditions largely determine the prognosis. Scarlatinal nephritis gives much less hope of recovery than does nephritis due to exposure to cold after alcoholic excesses. Recovery usually takes place easily after the acute parenchymatous degeneration that accompanies diphtheria, typhoid, and other infectious fevers, as well as pregnancy. In acute yellow atrophy, however, and in yellow fever, cholera, severe phosphoric or mercurial poisoning, death may occur from the intense and widespread necrosis of renal epithelium. The dropsy and albuminuria gradually diminish in favorable cases of ordinary exudative nephritis, while the color of the skin and the quantity of urine and urea increase; so that recovery is established in from three to six weeks. The albumin may persist for some time after the disappearance of the dropsy, and then gradually disappear; rarely, however, in unfavorable cases, albuminuria may continue and the affection become chronic parenchymatous nephritis, even after the dropsy has disappeared.

Acute nephritis presents a number of serious and often dangerous symptoms. Among these are severe general œdema, dropsical effusions into the serous sacs (as hydrothorax), uræmia (especially when beginning with cerebral manifestations, as convulsions or coma), and, finally, inflammation of the internal organs, as pneumonitis, pleuritis, pericarditis, peritonitis, and meningitis. Recovery is quite common in cases of marked general dropsy in the absence of uræmia. Suppression of the urine, however, if it last more than twenty-four or forty-eight hours, is usually a fatal symptom. In those cases, also, in which the nephritis has a productive character, the prognosis is unfavorable, though life may, in some cases, be prolonged for several years.

Treatment. — The first object in the treatment is to relieve the congestion and inflammation, since the renal function is diminished by these conditions; by these means we restore the excretory function. It is, therefore, in order to restore the functional equilibrium by their antiphlogistic influence, that the single or combined use of diaphoretics and cathartics is employed, and not that the skin and bowels should be made to perform the work normally done by the kidneys.

Absolute rest in a warm bed and in a warm room is of primary importance, and, in order to promote a constant and free action of the sweat-glands, woolen underwear and blankets should be used. These measures are of importance both in mild and severe cases.

The diet should consist of bland liquid foods only, and the patient should be urged to drink freely of water (plain, distilled, or carbonated), lemonade, skimmed milk, or buttermilk, all of which are of especial value when hot. Thin meat-broths may be allowed later in the course of the disease, although a strict milk diet is preferable.

In rare cases in which there is severe

pain, local blood-letting, by means of leeches or cupping over the loins, may be useful; these measures are seldom needed, however, and a more salutary effect may often be gained by hot fomentations.

Treatment of the early stage of acute nephritis by Professor Baccelli's method, which consists of the abstraction of blood from the foot. The rationale of the treatment is based on the fact that the venous supply in the kidney is high, and that when the organ is inflamed the pressure is still greater. This condition leads to a degeneration of the renal epithelium, with the disastrous consequences which follow this lesion. Bleeding from the foot tends to cause a diminution of pressure in the inferior vena cava, and hence also in the renal veins. The amount of blood which should be withdrawn naturally varies in each individual case, but in the adult should not be less than 300 cubic centimetres in children the quantity must be proportionately reduced. De Rossi (Il Policlinico, Feb., 1904).

Diminution of the œdema and the elimination of urea and other urinary constituents retained in acute nephritis are best attained by exciting a profuse perspiration. The congestion of the kidneys is also relieved by this vicarious action of the skin. The same results may also be accomplished by means of the hot-air or hot-water bath and the hot wet pack; in most cases the last method proves effective. It is easily applied by wringing a blanket out of hot water, wrapping the patient in it, and surrounding him, first with a dry blanket and, finally, with a rubber cloth. According to the condition, the patient may remain in this improvised steam bath until free sweating has continued for an hour or more. Children suffering from scarlatinal nephritis may either be treated thus, or by immersion in hot water for twenty, thirty, or more minutes; the child is then wrapped in warm sheets or blankets, after lightly drying the skin, and warmly covered in bed. Hot air or vapor may also be generated beside the bed and introduced beneath the cradled bed-clothing by means of a tin funnel and pipe. The drinking of hot lemonade or soda-water, or of water containing spirit of Mindererus, will stimulate the sweating. Should these measures fail, as in uræmia, perspiration may be started by an hypodermic injection of pilocarpine, $^1/_8$ to $^1/_6$ grain; it will then continue to pour out upon the application of heat. Serious consequences sometimes attend the use of pilocarpine, and the heart and pulse must always be carefully watched. The sweating should be repeated as often as the patient's strength will permit, until the dropsy disappears.

Pilocarpine liable to produce a kind of bronchorrhœa which is almost always fatal. Case seen in consultation of a child, 2 years of age, who had recently had scarlet fever. The attack was not a severe one, but it was followed by kidney disease, which resulted in general anasarca. A single dose of pilocarpine was administered, and as a result of this bronchorrhœa was rapidly produced, accompanied by the most intense dyspnœa, so that the patient soon succumbed. Other cases seen, however, in which the remedy acted with the most happy effect. J. Lewis Smith (Med. News, Aug. 1, '96).

While pilocarpine is a dangerous remedy, which should always be used with great discrimination, bad effects never personally observed from its use; only from $^1/_{12}$ to $^1/_6$ grain administered, however, usually combined with some cardiac stimulant, such as strychnine or digitalis. J. Blake White (Med. News, Aug. 1, '96).

The key in the successful employment of dry hot air in the treatment of Bright's disease, or *any other disease*, consists in bearing in mind the fact that the agent is simply a rational ther-

apeutical measure, exhibiting a known and constant physiological action, which furnishes a logical basis upon which to consider its application to a given case if the case in question presents a known pathology. It will, alone and unaided, cure some disease processes; others will require that additional agents be combined with it; and in still others all the curative resources at our command will not suffice to effect the patient's recovery. It exhibits in a marked degree the capacity to increase our power to overcome pathological conditions, and because of this and the effectiveness of its influence in many situations unmanageable with other remedial measures it is entitled to a prominent position in our armamentarium. C. E. Skinner (N. Y. Med. Jour. and Phila. Med. Jour., Dec. 12, 1903).

Hydragogues, as elaterium, the saline cathartics, and compound jalap powder, are useful as adjuvant measures. The extract of elaterium ($^1/_6$ to $^1/_4$ grain) is prompt in action, and magnesium or sodium sulphate (1 drachm) given in hot concentrated solution every hour, or a calomel purge, may also be recommended. In extreme cases of dropsy it may be necessary to relieve the tension and distress by the use of a small trocar and cannula, with a drainage-tube (Southey) attached to the latter after the trocar is withdrawn, or by multiple punctures. If either hydrothorax, hydropericardium, or ascites assumes serious features, aspirations will become necessary. To the diaphoretic treatment may be added $^1/_2$-ounce doses of the spirit of Mindererus in water. This, combined with aconite, aids in controlling the fever that may be present and in preventing the vasoconstriction that is often premonitory of uræmic symptoms.

If the uræmic convulsions do not promptly yield to diaphoresis and catharsis, venesection must be resorted to, the withdrawal of as much as a pint or two of blood often saving life. Occasionally inhalations of chloroform are needed to subdue the violent convulsive seizures, as in eclampsia. Their recurrence may be prevented by the use of rectal injections of potassium bromide (1 drachm) and chloral ($^1/_2$ drachm).

Contraction of the arteries with increased tension and beginning muscular twitchings require the use of chloral-hydrate, nitroglycerin, and, possibly, morphine.

Nausea and vomiting may be held in control by minute doses of cocaine, cracked ice, dilute hydrocyanic or hydrochloric acid, bismuth, or by the addition of soda- or lime- water to the milk.

There is little advantage in diuretics other than the simple diluent drinks already mentioned, at least early in the course of the disease. Later, potassium bitartrate or acetate, sodium benzoate, as adjuvants to the water, and stimulants to relieve cardiac depression, or caffeine citrate and the infusion of digitalis, may be given, well diluted.

In infectious nephritis of young subjects, with or without anasarca, tincture of cantharides in doses of 10 to 12 drops is very beneficial. It is contraindicated in the interstitial nephritis of arteriosclerosis and in lead poisoning. Mlle. A. Myszynska (Thèse de Paris, No. 24, '96).

Care must be taken during convalescence that the patient be not exposed to cold. The diet must not be changed to solids either too suddenly or too rapidly, and particularly does this rule hold in the matter of meats. Milk should form the mainstay of the dietary, and light watery vegetables, fruits, and cereals may be gradually added. The anæmia will indicate the ferruginous tonics.

The fatal result is reached in many cases only because the rigid course of

management necessary to stem the progress of the disease is not enforced until irreparable mischief is done to the kidneys. The patient should avoid fatigue, mental wear, errors in diet, exposure to cold or damp, and keep the skin thoroughly protected. The urine should be examined at stated periods (monthly) to ascertain whether any trouble is still lurking or has been redeveloped. Jacob Price (Med. and Surg. Reporter, Apr. 24, '97).

Not a single exact clinically experimental basis found in all the literature for the exclusion of dark meats in chronic nephritis, but only hypothetical affirmations over the greater content of irritating products (especially nitrogenous extractives) for the kidneys in brown meat. In a personal case a patient with chronic parenchymatous nephritis who took ½ pound of poultry daily for five days excreted the same amount of nitrogen and a trifle more albumin than he did in the next five days, in which, instead of the poultry, he took an equivalent amount of nitrogen in beef.

In many cases also a restriction of the amount of fluids to 42 or 50 ounces can be of great advantage. This treatment is peculiarly applicable to those cases with cardiac asthma and dilation of the heart. Patients with interstitial nephritis suffer no diminution in the elimination of the important metabolic products by the restriction of liquids to 1¼ litres. Von Noorden (Verhandl. d. Cong. f. innere Méd., p. 386, '99).

Indication for milk diet. The prevailing custom to put the patient on a strict or partial milk diet has been strongly condemned by von Noorden, Lancereaux, and others, the second named holding that it is only advisable in desquamative nephritis, and not in the interstitial variety.

Great care should be taken to determine whether the albuminuria is functional or due to a kidney lesion, which can only be ascertained by a prolonged and careful investigation of the patient's antecedents and habits. If it be concluded that there is a chronic nephritis, the medication must assume a depurative character, as no medicines are capable of curing the disease. Milk is very valuable in such cases. In functional cases, however, the cause may be nervous, gastro-hepatic, gouty, or due to gravel, rapid growth, or menstrual disorder, and here treatment should be directed to the cause. As a result of neglect, such transient albuminuria may become permanent, owing to chronic injury of the renal epithelium. In these cases milk may be largely used or not, as may seem best in regard to the general health and nutrition, and its digestibility in individual instances. Marboux (Lyon Méd., Feb. 11, 1900).

Indications for milk diet. In cases of functional albuminuria, as in the early stage of gout or in lithiasis, at the time of puberty, menstrual or digestive albuminuria, an exclusive milk diet evokes no other result than great weakness and sometimes an intense degree of anæmia, without causing a disappearance of the albumin. The same cases improved under a mixed diet in combination with some water cure. It is necessary to determine the source of the albuminuria. If a chronic nephritis of whatever origin is present, the nutrition of the patient must be the first consideration. Here milk is at once a medicine and a food. If simple albuminuria with no renal elements in the sediment is noted, if it is dependent upon some nervous, gastro-hepatic, or gouty factor, or if a calculus is the cause, the cause must be treated, since the albumin may eventually have a deleterious effect upon the epithelium of the kidney. In such cases a mixed diet containing milk is to be advised. Victor Scheiber (Wiener med. Blatter, Mar. 8 and 15, 1900).

Patients with chronic nephritis seem to thrive best on a mixed meat diet, neither the white nor the dark meat of fowls appearing to be injurious. A. Pabst (Berliner klin. Woch., June 18, 1900).

Carefully regulated habits in regard to dress, exercise, and diet, and a change to a warmer, drier, and more equable climate, are necessary in cases that are convalescent from the very serious forms of nephritis, in which the renal paren-

chyma, by the persistence, at intervals, of a slight albuminuria, is shown to have been somewhat damaged.

In acute nephritis in children, rest in bed and strict milk diet; from one to two scarified cuppings on each side of the spine, with mustard plasters; every two hours 2 1/2 drachms of benzonaphthol and 2 1/2 drachms of milk-sugar in an effusion of cherry-stalk; morning and evening cold boiled-water enema; once or twice a week julep and scammony; dry friction of the body, and asepsis of the mouth. Perier (Jour. de Méd., Apr. 29, '94).

When acute or subacute attack appears, more or less long sojourn in bed, patient lying between blankets. Warm climate, but not on or near the sea. Brushing of skin, but no baths, lest patient take cold. Moderate exercise or massage. Pregnancy contra-indicated; sexual sobriety important. Milk the food and medicine *par excellence*; 2 quarts daily need not be exceeded. When marked improvement, vegetarian diet. Purgatives and diuretics only remedies needed, and caffeine subcutaneously if heart show sign of failure. Sapelier (Bull. Gén. de Thér., Nov. 30, '94).

Hot baths and milk diet best measures. Diuretics useless. Though calomel acts as such, stomatitis is difficult to avoid. Repenak (St. Petersburger med. Woch., Apr., '95).

Examination of six thousand specimens at Denver, a mile above sea-level. Influence of high altitude: Acute nephritis, though uncommon, is exceptionally severe. Amyloid disease is less frequent than text-books infer. Chronic parenchymatous nephritis is not influenced. The chronic interstitial type of this disease is influenced favorably by the tonic, invigorating climate. Slight, transient albuminuria, due to high blood-pressure, is frequent. E. C. Hill (Jour. Amer. Med. Assoc., May 12, 1900).

Puncture of the kidney has recently been recommended.

Puncture of the kidney to relieve tension and cause cessation of albuminuria. Exploration of the kidney had been undertaken to discover if there were a co-existing morbid condition present. Good results followed and appeared inexplicable. They were thought to be due to such factors as the division of a nerve, the moral effects of the operation, etc. After several cases showed the same results, a different explanation became necessary. In three subsequent cases, one of scarlatinal nephritis, one of nephritis from exposure to damp and cold, and one of nephritis following influenza, the albumin disappeared from the urine directly after surgical treatment; it was, therefore, believed that the albuminuria was due to a state of tension in the kidney, which was relieved by the operation. In a proportion of cases of nephritis albuminuria disappears; in others it is very persistent. It is in these that surgical exploration of the kidney is indicated. This is particularly the case when the kidney complication is grave from the outset and there is more or less suppression of the urine, and when, after a limited time, the renal symptoms do not tend to disappear. The operation of exploration is so safe that it is justified in all severe renal disorders. "The kidney should be exposed by a moderate incision from the loin, so as to enable the operator to feel the organ distinctly both in front and behind, aided, of course, by pressure exercised on the kidney by the hand of an assistant from the front of the abdomen. If, in conjunction with the presence of albumin in the urine, the kidney is found in a state of tension, such as I have illustrated, three or four punctures may be made through the capsule in various directions; or, should the organ be found in a state of higher tension, then a limited incision into the cortex may be practiced. After one or other of these measures has been executed, the wound should be lightly packed with gauze or a drainage-tube substituted. In either case the incision should be dressed in such a manner as to provide for the free escape of either blood or urine or whatever products may be exuded." Reginald Harrison (Med. Weekly, Oct., '96; Med. Record, Nov. 7, '96).

Case of a woman suffering from a nephritis with profuse hæmaturia and alarming symptoms of uræmia in which the disease was checked by a nephrotomy. Results given in 24 instances of intervention in nephritis, complicated by grave symptoms. In 9 cases of nephritis with hæmaturia there were 7 nephrectomies with 2 deaths and 5 recoveries, 1 nephrectomy with recovery, 1 simple exploration with recovery. In 4 cases with subacute infectious nephritis these were submitted to nephrectomy and all recovered. In 8 cases of acute infectious nephritis there were 3 nephrectomies with recovery, and 5 nephrotomies with 2 deaths and 3 recoveries. As to the therapeutic results, in the first set the hæmaturia disappeared at the same time the urinary secretion and elimination of urea were re-established. The pain abated in the nephralgias. The albumin disappeared in the cases of subacute nephritis, and the fever and other symptoms in the severe infectious cases also disappeared. Pousson (Jour. Cut. and Genito.-Urin. Dis.; Ther. Gaz., Apr. 15, 1900).

Exudative Chronic Nephritis.

Definition.—A chronic diffuse inflammation of the kidneys, attended with epithelial degeneration, exudation from the blood-vessels, and permanent connective-tissue changes in the renal stroma. This is one of two varieties of chronic Bright's disease, and is identical with Delafield's chronic productive (or diffuse) nephritis with exudation.

Symptoms. — The symptoms of an acute parenchymatous nephritis may persist in a lesser degree until the condition becomes a chronic one; particularly is this true of the albuminuria, the anæmia, and the dropsy. As a rule, however, the disease develops slowly and gradually, and in a subacute manner, although there is seldom an early indication of renal derangement. There may be merely a loss of appetite, attacks of indigestion, nausea, headache, dullness, perhaps some pallor, and a general impairment of health and strength. The complexion then takes on a blanched appearance and there is soon puffiness of the eyelids or swelling of the feet or ankles, or both. There is a gradual extension of the œdema up the legs, and as the day grows it becomes worse; on rising in the morning it may have entirely disappeared. In the majority of cases the quantity of urine is diminished. In the later stages of the disease, however, it may be nearly or quite normal, and in protracted cases of pale contracted kidney, or when absorption of the dropsical effusion is in progress, it may even be slightly increased.

An acute nephritis supervening upon the chronic condition may now cause a very scanty or suppressed secretion of urine. In cases of scanty urine the specific gravity is, of course, increased, and *vice versâ*. Albuminuria is often present to a decided degree. The albumin may constitute from one-fourth to three-fourths of the urine in volume, or from 1 to 3 per cent. by weight; thus the daily loss of albumin may be considerable.

The clinical significance of albuminuria as a symptom has undoubtedly diminished during the last twenty years. Cases of "functional" albuminuria constitute from one-half to one-third of all the cases of albuminuria that come under notice. Ralfe (Brit. Med. Jour., Feb. 20, '93).

Six cases in which autopsy showed the presence of Bright's disease, and in which the urine, carefully examined during life, showed, at certain times, no albumin, although symptoms of uræmia were present. These observations, together with similar ones of Lépine, Lancereaux, and others, tend to show that albuminuria is not always a faithful symptom in nephritis. Dieulafoy (Bull. de l'Acad. de Méd. de Paris, June 6, '93).

Certain cases of Bright's disease may

exceptionally, and sometimes for a rather long period, show no albumin in the urine; but there may sometimes be renal insufficiency without serious renal lesions. Too often a case is diagnosed as a contracted or enlarged waxy kidney, when the autopsy shows but slight lesions; diagnosis should only have been renal insufficiency. Lépine (Lyon Méd., July 9, '93).

Casts are invariably present when a true organic lesion exists. Cardiovascular tension is another symptom almost invariably present in the early stages of renal cirrhosis. Occipital headache, with momentary attacks of vertigo, is rarely absent. In addition, there is usually a somewhat ill-defined appearance of want of perfect health, restless movements, coated tongue, foul breath, pale lips, and lifeless or waxy appearance of the skin. Danforth (N. Y. Med. Exam., Aug., '93).

Albuminuria is absent in the interstitial forms, while the skin is frequently dark in color in the parenchymatous forms. Dabney (Inter. Med. Jour., Nov., '93).

No albumin is to be found in the urine in some cases of nephritis. Such a nephritis may be due to the introduction of a specific virus from the external genitals. Fienga (N. Y. Med. Record, Apr. 21, '94).

Rapid elimination of such substances as iodide of potassium, quinine, turpentine, and the bromides shows that the kidney is healthy, while delayed or diminished elimination gives sufficiently precise information as to the degree to which the organ is affected. Bassett (N. Y. Med. Record, Apr. 21, '94).

Presence or absence of albumin in the urine is not nearly of as much diagnostic and prognostic importance as the morphological evidence of kidney disease afforded by the presence or absence of casts. Ludwig Bremer (Med. Review, June 29, '95).

The quantity of urea is much diminished. The urine contains an abundant sediment, consisting of urates, casts, red and white blood-corpuscles, epithelial cells, granular *débris*, and fatty granular cells, and is in color turbid and sometimes smoky-yellow. There are tube-casts of different varieties, the narrow or broad hyaline, fatty granular, and epithelial casts being most commonly noted.

The œdema is prominent and persistent, gradually extending all over the body; thus pitting may be obtained on pressure on the limbs, chest, abdomen, and back.

The author investigated the blood of patients suffering from nephritic œdema to determine the presence of lymphagogic substances. A number of nephritics were bled, the blood being injected into dogs. The quantity of lymph discharged was then estimated. It was found that after the injection of the serum this was about three times as great as before. Blood was therefore taken from some healthy men and injected, and it was found that the quantity of lymph was not increased. There seems, therefore, to be some substance in the blood of patients suffering from nephritis that irritates the lymph-secreting tissues. Kast (Deutsches Archiv f. klin. Med., Bd. 73, 1903).

The loose subcutaneous tissues, as of the penis, scrotum, and eyelids, are especially distended. Only in chronic hæmorrhagic nephritis may the œdema be absent or very slight. Chronic exudative nephritis, especially with large white kidney, shows a pasty, pallid skin and anasarca as its most distinguishing characteristics. For several months the dropsy may be of moderate degree and almost stationary; it then grows worse insidiously, in spite of all efforts at treatment, and death ensues in a month or two.

Case in a man, 50 years of age, in whom œdema had occurred in various positions: face, hands, feet, and scrotum. At one time he was rather suddenly seized with severe attack of dyspnœa, due to an œdema of the pharyngeal walls and those of the upper part of the larynx. In the course of sev-

eral days, under the use of a spray of carbolic acid and an absolute milk diet, the œdema disappeared. Mendel (Ann. des Mal. de l'Oreille, etc., May, '91).

Form of œdema which is to be excluded in the consideration of the symptoms of Bright's disease. It is superficial in persons free from any traces of albuminuria and unaffected by any alterations of heart or lungs. In none of the cases met has the author been able to establish any relation with the hæmic condition, as in chlorosis. The administration of iodide of potassium having led to rapid disappearance of the œdema from four cases, the phenomenon ascribed to some syphilitic affection of the vasomotor system. Tschirkow (Meditzinskoje Obozrenije, No. 2, '91).

A large number of cases in which œdema of the glottis was the only symptom of Bright's disease localized in the larynx. Occurs as an incident in the course of the disease or as the initial symptom of latent Bright's disease. Twelve such cases recorded. It may lead to death in several hours. Maire-Amero (Ann. des Mal. de l'Oreille, etc., Mar., '94).

Three cases of swelling of the eyelids associated with occasional albuminuria, two cases of occasional swelling of the eyelids but without albuminuria, and one case of occasional swelling of the eyelids in which albumin was always present in the urine, all in children. In none was there a history of scarlet fever. These may indicate the early stages of insidious nephritis with small white kidney, but more likely only of vasomotor instability or defective metabolism. T. Fisher (Brit. Med. Jour., Apr. 14, 1900).

There may be present in serious cases dropsy of the serous sacs, with its accompanying distressing symptoms; œdema of the larynx and lungs may then supervene, causing sudden death. Dyspnœa may occur, both toxic and nervous, as well as mechanical or cardiac, in origin. On lying down, cardiac dyspnœa, due to failure of the heart's action and seen in many instances, is aggravated, as a rule.

Dyspnœa of uræmia is divided into three forms: simple, characterized by acceleration of respiration and diminution of the fullness of respiration; paroxysmal, or Cheyne-Stokes, in which a period of apnœa alternates with one of dyspnœa of regularly varying fullness and the spasmodic, which closely simulates spasmodic asthma. Lancereaux (Jour. of Nerv. and Mental Dis., May, '91).

In many instances there is too great a tendency to regard as cardiac a toxæmic dyspnœa. In such cases of dyspnœa, where no auscultatory symptoms are present, even if the urinary phenomena are not calculated to impress very strongly the fact of a decided renal alteration, the possibility of uræmic origin should be gravely considered. Several instances where the withdrawal of cardiac stimulants and morphia, given with a view of correcting a cardiac error, and the substitution of remedies and measures for the correction of a toxæmia, were followed by a successful result. Landouzy (Jour. de Méd. et de Chir. Pratiques, Aug. 10, '91).

[It has long been believed that the dyspnœa of advanced Bright's disease is of toxæmic origin, and so it probably is in a number of instances; at least, in a certain degree. But, aside from the direct action of the toxic retention substances upon the respiratory centres or upon the respiratory tissues, there must be remembered the circulatory element. Allen J. Smith, Assoc. Ed., Annual, '92.]

Attention called to the many similar features between the dyspnœa of Bright's disease and that from accepted cardiac origin, — the breathlessness on even slight exertion, the distressing paroxysms at night, the influence of the horizontal position in increasing the severity, and the fact that Cheyne-Stokes respiration is not infrequent in either. Steell (Med. Chron., Oct., '91).

Particular attention to the high arterial tension in cases of chronic Bright's disease, and to the renal inadequacy and retained substances as an important factor in the etiology of the symptom. Musser (Times and Register, Oct. 17, '91).

It may be provoked by vasoconstriction, and is, in such cases, a signal of uræmia.

> Form of uræmia which manifests itself in the mouth and pharynx: bucco-pharyngeal uræmia. Marked by the presence in the mouth and pharynx of a thick, gummy mucus, covering the walls of these cavities. When it is detached the membrane beneath is red and dry, but not ulcerated, although the similarity to a pseudomembranous formation is close enough to mislead the incautious. It is not infrequently accompanied with hiccough, bulbar dyspnœa, and other cerebro-spinal phenomena, and presents a number of analogies to vomiting known to be of central origin. Lancereaux (Sem. Méd. and Gaillard's Med. Jour., Mar., '91).

With these conditions may be associated catarrhal bronchitis, with cough and expectoration.

There is frequently a moderate degree of cardiac hypertrophy of the left ventricle; later there are dilatation and weakness of both ventricles. There is an accentuation of the aortic second sound and an increase of the pulse-tension.

> Origin of the cardiovascular changes in Bright's disease; the hypertrophy of the heart is a true hypertrophy with, in some cases, a mild interstitial myocarditis, the left ventricle alone being enlarged in a little over half of the cases, the remainder showing enlargement of both ventricles, the right never being enlarged alone; the changes in the blood-vessels are first an inflammation affecting the intima, and then a secondary degeneration both of the intima and of the muscularis, which is not hypertrophied, even when thickened. Two divisions may be made to include the cases of associated cardiovascular and renal disease, the first being arterio-sclerotic in which some irritative substance in the blood, such as lead or the poison of gout, excites a primary endarteritis in the whole arterial system including the kidney; the second division includes those cases in which the renal disease is primary, and, as the damaged kidneys are unable with the ordinary rate of the circulation to eliminate all of the products of metabolism brought to them, those which remain behind influence the heart through the nervous system to propel the blood faster, and hypertrophy results; when this hypertrophy affects the right ventricle it is the result of the increased blood-supply to it; the blood-vessels become affected later, both by the original cause of the renal disease and also by the toxic state of the blood due to defective renal function. Tyson (Jacobi Festschrift; Phila. Med. Jour., May 26, 1900).

Headache, vertigo, sleeplessness, nausea and vomiting, diarrhœa, and stupor, coma, or delirium may all develop and form the symptoms of a uræmic condition.

These symptoms, as a rule, precede a fatal termination. The convulsions that are common to chronic nephritis without exudation do not appear, however. In quite a large number of cases albuminuric neuroretinitis occurs, and is evidenced by dimness of vision and field-defects. In certain cases of marked œdematous distension the skin of the legs becomes subject to a red eczematous eruption. The temperature is practically normal in the absence of such complicating inflammations as pericarditis, endocarditis; pneumonitis, and ulcerative colitis, all of which are rare conditions.

Chronic exudative nephritis may either continue from bad to worse, and death may end all in a year or two, or anæmia, albuminuria, and dropsy may appear in a person that has, for years previously, enjoyed apparently good health. After a first attack a second proves fatal within a few months. On the other hand, certain cases may show a slight pallor, a slightly diminished quantity of urine of high specific gravity,

and containing albumin, and yet may complain of no inconvenience for years. Decided attacks may then occur at intervals, during which the dropsy, dyspnœa, etc., may be absent, although a certain amount of albuminuria persists; these attacks last for several months. The average duration of the disease varies from one and one-half to three years.

Etiology. — Chronic nephritis with exudation may either follow acute diffuse nephritis (as of scarlet fever or pregnancy), or simple chronic congestion and chronic degeneration of the kidneys. It arises insidiously more frequently, however, and without any previous acute manifestation. Males are more subject to this form of chronic Bright's disease than females. Cases occurring in children are usually preceded more or less recently by scarlatinal nephritis.

Heredity in chronic nephritis. Family history which showed in three generations in one family eighteen cases of chronic nephritis. Almost all the members of the family in these three generations were subjects of nephritis. They had the disease for years, but reached an advanced age, and, almost without exception, became uræmic and died in coma. The sex was equally divided. This series indicates a hereditary disposition of the kidneys to become diseased. Pel (Zeit. f. klin. Med., B. 38, B. 1, 2, and 3, 1900).

The chronic interstitial nephritis of children is more frequent in females than in males. The changes in the kidneys are not a further stage of parenchymatous nephritis, but are the results of a primary inflammation of the interstitial tissue of the organs. The disease is rarely caused by scarlet fever or any of the specific fevers. The disease may be congenital in its origin. It may owe its origin to congenital and inherited peculiarities of constitution. The disease may be due to an "ascending nephritis," starting in the pelvis of the kidney. The dilatation of the ureters and of the pelves of the kidneys may, however, be secondary to the interstitial change. Syphilis, either hereditary or acquired, may be the chief factor in the causation of the chronic interstitial nephritis of childhood, and may play a greater part in the etiology of the disease in adults than is usually attributed to it. Sawyer (Birmingham Med. Review, Aug., 1903).

Young adults are more commonly affected with the usual form, developing subacutely. Beer-drinkers, and those who are accustomed to using malt and alcoholic intoxicants, seem especially liable to the disease. Even in cases where other manifestations are absent, it is not improbable that, in the insidious cases, some toxic or infectious agency may act slowly and persistently, and be the cause of the nephritis.

The disease has been observed in certain individuals living in malarial regions, and persons working under an exposure to cold and wet, or living in humid, marshy districts, seem more liable to the renal malady than those who are more carefully shielded from such influences.

Acute form less frequent among soldiers in Algeria and Tunis than in France, showing the influence of temperature as cause; while the reverse is the case as regards the chronic form, pointing to effect of malaria in the etiology of Bright's disease. Famechon (Archives de Méd. et de Pharm. Militaires, Jan., '95).

Conclusions to be drawn from a study of the relation of chronic nephritis to malarial disease: In some localities malarial fever should be given a prominent position in the etiology of chronic as well as of acute nephritis. In all cases of malarial fever the urine should be closely watched. A blood-examination should be made in all cases of nephritis occurring in those who have visited or lived in a malarial district, as it often happens that the severe grade

of nephritis resulting may mask entirely the clinical picture of malarial fever. C. W. Larned (Johns Hopkins Hosp. Bull., July, '99).

This so-called "parenchymatous" form of chronic Bright's disease may find its cause in tuberculosis, syphilis, or chronic suppuration, and in such cases it is usually combined with amyloid disease (waxy degeneration).

Epithelial nephritis may follow in the course of syphilis, tuberculosis, and leprosy, and which are quite distinct. It begins suddenly, as does subacute nephritis, but its progress is slow. The urine is not abundant, is strongly albuminous, and the prognosis always grave on account of the danger of uræmia. Lancereaux (Le Bull. Méd., Jan. 11, '93).

Syphilis may lead to a nephritis rebellious to treatment. Dieulafoy (Bull. de l'Acad. de Méd. de Paris, June 20, '93).

Case developed suddenly without usual causes, during secondary period of syphilitic infection. Thiroloix (Concours Méd., July 13, '95).

The nature of chronic nephritis: 1. The different forms of Bright's disease are to be regarded as various stages in the same general process, there being a unity pervading the whole pathological picture. 2. All forms of nephritis are due, in the immense majority of cases, to infective agents; the acute, to the usual specific germs of the primary disease, and the chronic, as a general rule, to the bacillus coli, though other germs may sometimes be concerned. 3. Acute interstitial inflammation and subsequent connective-tissue hyperplasia are the keynote of the process; this is, however, preceded by parenchymatous degeneration. 4. The point of invasion by the bacillus coli is the gastro-intestinal tract; those of other germs may be various. 5. The liver and mesenteric glands are the first barriers of defense; and the endothelial cells of the capillaries and the secreting tubules of the kidney have the power of ingesting bacteria, this being an attempt at inhibition and elimination. A. G. Nicholls (Montreal Med. Jour., Mar., '99).

Pathology. — There are several types of kidney included in this disease, yet in all the changes of structure are essentially identical, and the variations, when they occur, depend upon the cause and duration of the nephritis.

The large white kidney (without waxy degeneration) may be either normal in size or enlarged, and is pale or yellowish in color. The surface is smooth and the capsule is easily stripped off. On section the cortex appears broader than normally, and is either yellowish white throughout or may present opaque yellowish or whitish areas with mattings of red. In some cases the pyramids are congested. The following changes may commonly be observed microscopically: The renal epithelium is swelled, hyaline, granular, or fatty, and is more or less disintegrated or flattened; there is an enlargement of the glomeruli, owing to the growth of the capsule-cells and of the cells covering the capillaries; and, in certain cases, as a result of the connective-tissue thickening of the capsule, the tuft of capillaries is atrophied. There is some thickening of the arterial walls, and a moderate growth of connective-tissue may be noted in patches around the glomeruli and tubules. The latter contain hyaline and granular casts.

The small white kidney (secondary contracted kidney) is, in most instances, probably a later stage of the preceding condition, in which the epithelial degeneration becomes more pronounced, and the connective-tissue growth and the resultant cicatricial contraction become prominent features. The kidneys are about normal in size; owing to a shrinkage in the large white kidney, the surface is slightly granular and the capsule proportionately adherent. In color they are usually grayish or yellowish (pale granular), and there may be a certain

amount of red mottling. The consistency is firmer than that of the large white kidney, and the surface, on section, shows, in the somewhat narrowed cortex, yellowish-white foci of fatty-degenerated epithelium; hence the term "small, granular, fatty kidney." Microscopically we find extensive degeneration and disintegration of the epithelium of the glomeruli and convoluted tubules, atrophy of the parenchyma, and a corresponding increase in the interstitial connective tissue. There may be an associated waxy degeneration.

The large red or variegated kidney of chronic hæmorrhagic nephritis forms a third variety. The kidneys are found, as a rule, enlarged, red, swelled, and congested-looking or mottled; frequently they are "bumpy," or slightly bosselated. The capsule is slightly adherent to the depressions between the bosses. The section shows congested portions and gray or yellow spots corresponding to the anæmic and fatty-degenerated portions. Red spots, due to small hæmorrhage, may also be noticed on both the outer and cut surfaces of the kidney, and small cortical hæmorrhagic areas or striations, brownish-red in color, are distinctive. Microscopically the appearances are those of acute nephritis superadded to those of the large white kidney, and consist of fatty granular degeneration, epithelial proliferation, atrophied capillary tufts, thickened glomeruli capsules, and, in some places, a growth of interstitial fibrous tissue. In either place inflammatory œdema and cellular infiltration of the intertubular tissue may be noted, as well as the dilated tufts of capillaries with surrounding cellular hyperplasia. This variety of chronic nephritis is frequently seen in inebriates.

Prognosis. — The prognosis is invariably bad, though life may, in certain cases, be prolonged. Death may occur in severe cases in from three months to a year, from uræmia, dropsy, dilatation of the heart, or from other complications. Cases of a year's duration seldom recover, and those in which advanced secondary contraction of the kidney may be assumed may be considered hopeless; they often terminate suddenly. Rarely there may be a complete recovery; this occurs particularly in children following an attack of scarlet fever. According to the quantity of urine passed in the twenty-four hours, and the amount and persistence of the albumin, is the prognosis made, as well as upon the degree of cardiovascular and retinal changes. Relapses may occur in apparently favorable cases, and acute attacks may supervene.

> Study of several hundred of cases of nephritis has shown that chronic nephritis is not an incurable disease; recovery occurs in rare cases. It may exist for years without causing apparent constitutional disturbance. The average duration in three hundred and thirty-two cases of chronic nephritis was nineteen months. Acute nephritis is less common than has been supposed; many cases that were formerly so classified are found to represent exacerbations of chronic nephritis. R. C. Cabot and F. W. White (Boston Med. and Surg. Jour., Aug. 10, '99).

Treatment.—This is conducted much as in acute nephritis. The uræmia and dropsy are treated symptomatically. The diet is of great moment, skimmed milk and buttermilk being depended on as much as possible when the dropsy is marked. When the dropsy is slight, more solid food, white meats, vegetables, and fruits, and an out-door life should be recommended. Prolonged, sudden exercise and severe exercise should be prohibited.

Importance of combating the tendency to anæmia, the prognosis remaining good as long as this condition is averted. Stephen Mackenzie (Brit. Med. Jour., Feb. 20, '93).

Woolens should be worn next to the skin, and residence in a warm, dry climate may aid in extending life.

Nitroglycerin may be needed in cases with contracted and tense arteries, with a tendency to uræmic twitchings, and digitalis may be useful in cardiac weakness. Basham's mixture for the anæmia and unirritating diuretics will prove of value, and strontium lactate, in doses of from 15 to 20 grains, three or four times daily, may be tried in some cases.

Three cases of nephritis treated by lactate of strontium; an excellent diuretic in the acute forms and in acute attacks occurring in the course of the chronic form. Da Costa (Med. News, Apr. 21, '94).

Child, 5 years of age, who suffered from chronic Bright's disease and whose urine contained large quantities of serum-albumin and globulin. Lactate of strontium increased the quantity of urine and solids excreted and the patient rapidly recovered. Gillespie (Med. Chronicle, Sept., '94).

Lactate of strontium is beneficial, in a large number of cases, when sclerosis has not begun. It produces nausea in powder, but not when dissolved in water, 1 to 6 parts, three or four tablespoonfuls being given daily. Ried (Med. and Surg. Reporter, Jan. 26, '95).

Lactate of strontium tried in 10 cases of Bright's disease: 3 of acute parenchymatous, 6 mixed, and 1 interstitial. The favorable action of salts of strontium on the kidneys is not due to their diminishing putrefaction in the intestines. Direct experiments with bacteria showing that the antiseptic properties of lactate of strontium are insignificant, and that the presence of ethero-sulphuric acids in the urine is not influenced by the use of the drug. Bronowski (Medycyna, No. 1, '96).

There is a great deal of mischief done by iron in Bright's disease. It may be laid down as a rule to which there is almost no exception that the iron is not indicated, and should not be prescribed, in cases of acute Bright's disease. On the other hand, after the acute symptoms have passed away and convalescence sets in, iron is very useful. A second class of cases in which iron is contra-indicated is chronic interstitial nephritis, in which it is more promptly and dangerously harmful than in any other form of Bright's disease. The form of Bright's disease in which iron is best borne is chronic parenchymatous nephritis. The proper dose should be determined by an examination of the stools, and, if these are decidedly blackened, too much is being given. Basham's mixture is no more diuretic than the bulk of water which constitutes its menstruum. James Tyson (Journal Amer. Med. Assoc., July 23, '98).

Methylene has also given satisfaction in some cases.

Methylene-blue is recommended in chronic nephritis. Dose, from 3 to 5 grains a day. Man of 58 years, suffering from chronic Bright's disease with renal congestion and albuminuria, was admitted to the hospital. On the 25th of February he was passing six grammes of albumin a day. He was given a modified milk diet and treatment with alkalies and tannin. Shortly afterward he was placed upon methylene-blue in dose of 4 grains a day. On the 3d of March he was passing four grammes of albumin; four days later he was passing two grammes; and on March 10th he was passing 20 grains. Lemoine (Jour. des Praticiens, May 22, '97).

Non-exudative Chronic Nephritis.

Definition.—A chronic diffuse inflammation of the kidneys, indicated by a growth of connective tissue in the stroma, degeneration and atrophy of the renal parenchyma, and by marked changes in the cardiovascular system.

Symptoms. — The symptoms may remain latent for a considerable time, even for years, while the morbid productive changes are gradually effected in the

kidneys. They may not become evident until late in life, even though the kidneys may be in an advanced state of degeneration. Some complicating condition may also supervene, as pericarditis or pneumonia, causing the development of grave renal symptoms. As a rule, however, uræmia makes its appearance with headache, stupor, or convulsions, dyspnœa, nausea and vomiting, and a tense pulse. This seizure may be recovered from. There is now an *interim*, of variable duration, in which there are drowsiness, lassitude, a disordered digestion, headache, failing vision, dyspnœa, and frequent micturition, with a more or less impaired general health. Then follows another uræmic seizure, still more severe, if not fatal. If not fatal, the general health is still more reduced, and confinement to the house or bed is necessary; at last the vital forces can no longer compensate for the destruction of the renal parenchyma. Contracted kidney may sometimes first be manifested by spasmodic dyspnœa (uræmic-cardiac). There is a marked gradual onset of periods of drowsiness during the day that are uncontrollable; an attack of hemiplegia may be the first sign of the disease. In other cases a progressive loss of flesh and strength, with a dry, harsh, wrinkled skin, may be, from the beginning, the only clinical features, until death results from sheer feebleness and emaciation. The variability and involvement of the symptoms render it advisable to describe them under the various systemic divisions.

There is an increase in the daily quantity of urine excreted so great that it causes a frequent desire to micturate, not only during the day-time, but two or three times through the night. This may be aggravated by the hyperacidity of the urine and by the irritability of the prostate gland (especially in advanced years) that are so often associated with renal cirrhosis. The total quantity of urine for the twenty-four hours may measure several quarts in marked cases of the disease. It may be slightly decreased early in the attack, when the degeneration and destruction of the parenchyma are in their incipiency; but, as the "blood-flow to the parts that remain must, *cæteris paribus*, be as great as it would have been to the whole of the organs if they had been intact," excessive pressure is brought to bear within the capillaries, owing to the compensating cardiac hypertrophy, and the secretion of the urine, especially of the watery elements, becomes more active. Diabetes may be suggested by the polyuria, but the urine is clear and pale-yellow in color, the specific gravity being seldom above 1010 or 1012, and it may be as low as 1002 or 1005. Albumin occurs in traces only, or may even be absent altogether (glomerular atrophy); this is noted especially in the urine voided in the early morning. The urea is diminished, and there is little or no sediment. On careful examination, microscopically, there may be found a few casts (usually narrow hyaline), perhaps some leucocytes, and, rarely, a few red blood-cells. Late in the disease or in the presence of a uræmic exacerbation or a complicating inflammation, the urine may be diminished in quantity, the albumin increased, and numerous casts be found in the more apparent sediment. Hæmaturia is a rare condition.

Latency of symptoms is quite constant in this disease, but does not constitute a point of distinction between the different stages of the disease. Symptoms are liable to be absent and urinary signs uncertain during the early stages; consequently the diagnosis during this period must generally be made

from physical signs rather than from symptoms or urinary findings. Albumin is frequently absent from the urine of this form of nephritis, especially during the early stages. It may not be present until the disease enters upon the final stage. Infrequently it is absent throughout the entire course. Albuminuria, therefore, constitutes a very unreliable diagnostic sign of this disease. When present, associated with physical signs and other urinary indications, it serves to complete the diagnosis, but if absent no contrary inference is justifiable. More reliable evidence of renal change is found in a diminution in the gross amount of urinary solids. Especial significance is to be attached to the presence of casts. Chronic interstitial nephritis never exists as a clinically recognizable condition without the presence of casts in the urine. While a diagnosis cannot be made on casts alone, they constitute a corroborative sign of high clinical value when associated with other indications. The secondary circulatory changes following chronic interstitial nephritis are so constant and characteristic as to furnish in most cases sufficient ground for the recognition of the disease. The diagnosis should be made, if possible, from the physical signs and symptoms, the urinary indications being regarded as corroborative rather than as essential evidence. A. R. Elliott (Med. News, Sept. 19, 1903).

Epistaxis may occur and constitute a serious symptom.

Conditions in which hæmorrhage may occur in Bright's disease: high tension, modifications in the structure of the arteries, and hypertrophy of the heart. Potain (Jour. de Méd. et de Chir. Pratiques, Aug. 10, '94).

Sudden œdema of the larynx may also supervene, and is always a grave condition. Transudations into the pleural sac (hydrothorax) and the lungs may precede the fatal termination. Dyspnœa is either uræmic or cardiac and is usually worse at night; a true orthopnœa, with Cheyne-Stokes breathing, may be observed in association with uræmic stupor and coma, and near the end of the patient's life.

The signs of hypertrophy of the heart (particularly of the left ventricle) may be elicited, though symptoms referable to the heart itself are absent, unless dilatation and feebleness, sudden arterial contraction, or endocarditis occur. Inspection and palpation show the apex-beat to be displaced downward and to the left, and the impulse to be increased, heaving, and rather circumscribed. In cases of co-existing emphysema, and later, when dilatation may eclipse the hypertrophy, these signs may become less evident. The left border of deep cardiac dullness extends outside the nipple-line in the fifth or sixth interspace. The first sound of the heart is loud and may be reduplicated. Accentuation of the aortic second sound is a distinctive sign, and indicates increased vascular tension; it may have a metallic quality in some cases. There may also develop a mitral systolic murmur as the result of relative insufficiency. There is increased tension of the pulse, the latter being hard, persistent, and incompressible; the pulse-wave is also increased in duration (*pulsus tardus*). Most of the palpable arteries are hard, thickened, and tortuous, owing to the arteriosclerosis. As soon as compensation fails, symptoms of breathlessness on exertion, palpitation, and the like, appear; often these occur in paroxysms and constitute "cardiac asthma." The resulting stasis causes a transudation into the lungs (bronchorrhœa, pulmonary œdema) and later to œdema of the extremities.

Of 106 fatal cases of chronic (interstitial) nephritis, 20 died from cerebral hæmorrhage; in all of these cases both kidneys were diseased, œdema of the extremities not being recorded in a single

instance and œdema of the lungs in only 2, thus showing that all was going on well until the fatal rupture. The remaining cases died from œdema, principally involving the lungs and pleuræ. Œdema is, therefore, the most common cause of death; this occurs in consequence of the stretching of the auriculo-ventricular orifice, allowing of regurgitation. A mitral murmur is by no means always present. Arterial sclerosis is marked in the cases dying from cerebral hæmorrhage, and this might account for the non-dilatation of the auriculo-ventricular orifices. The heart-sounds assumed a clanging tone in several instances preceding the fatal result observed. Hawkins and Russell Dodd (Clinical Soc. of London; Annual, '94).

Since they are indicative, as a rule, of grave uræmia, the symptoms referable to the nervous system are of great importance. There may be neuralgic pains throughout the body, and insomnia, and cephalalgia is frequent. Later great drowsiness is often a premonition of uræmic coma. Muscular twitchings may precede convulsions, and should attract attention to the imminent danger. Cerebral apoplexy with hemiplegia may form the first symptom of contracted kidney, and is apt to occur in cases of marked hardening and weakening of the arteries. Hæmorrhagic pachymeningitis and hæmorrhage into the brain-substance may also occur. The hemiplegia may last until the end, or it may disappear soon and be followed by subsequent attacks at intervals. Dieulafoy believes numbness, formication, and pallor of the fingers ("dead finger") to be sometimes the earliest symptoms of chronic Bright's disease.

The dead finger is a vascular trouble in cardiac disease, or an hysterical phenomenon, and has nothing to do with Bright's disease. The principal sign of renal insufficiency is the toxicity of the urine. The excretion of nitrogen in considerable quantity by the fæces is also a good sign. G. Sée (Bull. de l'Acad. de Méd. de Paris, June 27, '93).

Of the symptoms referable to the special senses nephritic retinitis often forms the earliest evidence of chronic Bright's disease. There may or may not have been present a slight dimness of vision prior to the ophthalmoscopical examination. There is a partial loss of vision in both eyes (amblyopia), and in grave cases sudden and complete blindness may come on (uræmic amaurosis) as the result of a neuroretinitis. The optic papilla is swelled, and surrounded by retinal hæmorrhages or by white dots and streaks ("feather-splashes").

The varieties of albuminuric retinitis are (1) neuritis (optic papillitis, or interstitial neuritis with swelling and round-cell infiltration of the connective tissue of the nerve, leading, in some cases, to atrophy of the nerve-fibres).

(2) Neuroretinitis, in which the retinal expansions of the optic nerve become swelled and ultimately granular and fatty. With these changes are associated white patches, of which there are two kinds: (*a*) rounded, soft-edged areas of lymph-exudation and (*b*) smaller, bright, radiated streaks or specks. The latter are mostly seen radiating from the yellow spot. Their glistening appearance is due to the refractive power of the minute oil-globules of which they consist.

(3) Periarteritis; chiefly affecting the outer coats of the arteries, and causing them to become thickened, and to encroach on the lumen so as to obliterate the smaller ones. This condition is associated with hæmorrhages and capillary dilatations.

(4) Diffused opacity of the retina from œdema.

Diagnosis: None of the ophthalmic appearances described are pathognomonic of Bright's disease. Similar forms of neuritis and neuroretinitis are met with in cases of cerebral tumor, while hæmorrhages may occur in cases of leucocythæmia, chlorotic and pernicious anæmia, and purpura. Multiple retinal periarteritis, though generally associated with

nephritis, is met with apart from this condition. The ophthalmoscopical appearance must always be confirmed by some of the more obvious signs of Bright's disease.

Causation: Four causes: (1) dyscrasia, or altered condition of the blood; (2) secondary degenerative changes in the small blood-vessels; (3) excessive pressure of blood within the vessels; (4) an inflammatory process of the affection of both vessels and nerves. Many regard the changes as purely degenerative.

Prognosis: The grave class of cases includes diffuse neuroretinitis, radiating patches around the yellow spot, and multiple periarteritis. These are most common in contracting granular kidney. When the changes are marked he would place the extreme duration of life at two years, whatever the state of the general health might be.

An exception to this rule is in the case of puerperal nephritis. Here the condition mainly depends on pre-existing dyscrasia of the blood, of which the retinal changes are only another local expression. Recovery is general, if pregnancy does not recur. The dyscrasia is not dependent solely upon renal disease.

The benign class of cases includes simple œdema, hæmorrhages, and soft-edged patches. All these conditions may subside, and their presence does not make the prognosis of the case better or worse.

One may conclude, therefore, that the prognosis is based upon the nature of the ophthalmoscopical changes discovered, and upon the nature of the nephritis which caused them.

In interstitial nephritis, retinitis is a measure of the general amount of vascular degeneration present. Advanced retinitis characteristic of interstitial nephritis, together with other signs of that disease, mean a speedy death.

On the other hand, signs of retinitis equally characteristic of other forms of nephritis are due to toxæmia rather than to vascular degeneration, and as such may be cured. Saundby ("Lectures on Renal and Urinary Diseases," '96; from review in Treatment, June 24, '97).

Tinnitus aurium, deafness, and vertigo are not uncommonly present.

Nausea, anorexia, and dyspepsia are frequent conditions. Severe vomiting may precede an attack of uræmia. Uræmic diarrhœa may occur, and there may also exist a catarrhal gastritis for some time, the tongue being thickly coated and the breath heavy and urinous.

Examination of the conditions of the stomach in twenty-six cases of chronic parenchymatous and interstitial nephritis, mostly in middle-aged patients, showing that renal disease has a marked influence upon the chemistry of gastric digestion. Kravkoff (London Med. Recorder, Jan. 20, '91).

Warning against the administration of an opiate in any diarrhœal patient above 50 years of age, owing to the untoward effect of opium in cases of renal insufficiency. Musser (Times and Register, Oct. 17, '91).

Digestive troubles associated with diseases of the urinary apparatus often disguise the latter. Alapy (Revue de Thér. Médico-Chir., Oct. 15, '93).

Twenty-two cases of ulceration of the intestine coincident with renal affections, and eight cases of hæmorrhagic extravasation without ulceration. Situated at all points of the intestine, but especially about the ileum, principal characteristic being that they were accompanied by hæmorrhage. Dickinson (Brit. Med. Jour., Jan. 13, '94).

Complications in the digestive tract. Examination of 17 cases,—3 of large waxy kidneys and 10 of secondary and 4 of primary contracted kidney,—intestinal lesions in most of them, from simple catarrh to diphtheritic exudation. Fischer (Deutsche med.-Zeit., Aug. 9, '94).

Minor nephritic complications: Cryæsthesia, cramps in the calf of the leg, and the itching of the skin are attributed to slight uræmia by Dieulafoy. They occur in individuals with perfectly sound kidneys, and are of gastric origin.

Headache, vertigo, ocular disturbances, ringing in the ears, lumbar pain, often considered to be serious symptoms, have the same etiology and vary with the degree of dyspepsia. Even the "electric shock" is common in dyspeptics, and the same may be said of the well-known mental depression. Dyspnœa, palpitation, œdema, polyuria, epistaxis, all attack the patient whose nervous system is exhausted and whose blood-vessels may be slightly sclerotic, from age or from a prolonged and severe dyspepsia, or both. Chryssovergis (Semaine Méd., June 15, 1904).

There is, as a rule, no œdema in renal sclerosis, and when it does occur (as in the ankles and limbs) it is due to cardiac dilatation and failure. The skin is dry, and the pores sometimes appear lustrous with minute scales of urea. The skin has often, also, a cyanotic tinge, with a certain degree of pallor. Troublesome eczema and pruritus are often present, and muscular cramps may make the patient still more uncomfortable; the latter occur at night and especially in the calves of the legs. Other cutaneous disorders may also occur.

1. There is a bright-red diffused rash which appears chiefly on the trunk, less extensive on the neck, arms, and thighs, and very seldom on the face, hands, or feet. It is distinguished from the somewhat similar rash produced by natural or artificial diaphoresis by its locality, by the absence of sudamina, and by its appearing when no hot-air baths or other means have been used to produce sweating and when the skin is harsh and dry. As it does not, as a rule, either itch or smart, and only remains a few days. Most often seen in cases of chronic tubal nephritis.

2. There is a papular eruption with large, discrete, rather dark-red pimples seated on a dry, rough, and sometimes scaly surface. This more often seen on the outer side of the thighs and legs, the shoulders, and extensor surface of the forearms, but it also may affect the loins and the abdomen. Personally never seen on the face or on the hands and feet.

3. Apart from the mere coincidence of eczema with Bright's disease, there may be observed in some cases a moist dermatitis resembling eczema in its aspect, but accompanying the arms or the legs, without affecting the flexures of the joints, the face or the ears, without the irritation commonly present, and without having previously appeared.

4. On two occasions a very extensive and profuse dermatitis seen, closely resembling the universal exfoliative dermatitis of Wilson, very red, very scaly, occupying the scalp, palms, soles, and genitals, as well as the trunk, face, and limbs. It has come on after the symptoms of Bright's disease have appeared, in cases of chronic interstitial nephritis, with little dropsy, and cardiovascular changes already apparent. P. H. Pye-Smith (Brit. Med. Jour., Nov. 30, '95).

Debility and emaciation become extreme, with the gradual failure of the general nutrition.

Uræmia may supervene at any time, and may even form the first symptom; it may also be sudden and severe in its attack (acute uræmia), or gradual, mild, and insidious (chronic). These uræmic attacks may be accompanied by either a normal temperature, or by moderate fever; the temperature may even be subnormal, in chronic uræmia with prostration, coma, a feeble pulse, and delirium.

Among the complications that may occur in the red, granular, and contracted kidney are the following: Pleuritis, endocarditis, pericarditis; pneumonia, either lobar or lobular; laryngitis, bronchitis, hepatic cirrhosis, gastritis, enteritis, peritonitis, meningitis, emphysema, phthisis, and mental disorders.

Early in the establishment of chronic Bright's disease, especially the interstitial variety, the mind seems somewhat fogged or "muddy," the soundness of business judgment is apt to be impaired; there are irritability, petulance, and de-

pression often noted; the patient may become a little self-distrustful, suspicious, or somewhat secretive about his affairs or intentions; he is easily annoyed by loud noises, is disinclined to exercise his intellect, apt to doze in the day and be wakeful at night, and in many ways indicates the approach to the borders of insanity. Andrew Clark (Brit. Med. Jour., Feb. 4, '83).

Case of a patient who suffered from insanity and chronic nephritis. Whenever the renal disease was exacerbated, the patient's mental condition also became worse.

Case of a lady, in whom the autopsy showed interstitial nephritis, who passed the last weeks of her life in a state of acute delusional insanity. Raymond (Gaz. Méd. de Paris, Nos. 25 and 26, '90).

Similar case, except that the patient became cataleptic and manifested bulbar phenomena a short while before death. Brissaud and Lorring (Gaz. des Hôp., Nos. 31 and 32, '90).

Important to distinguish those cases where the insanity exists along with, but independently of, the renal condition, not being influenced either in its inception or in its manifestations by the nephritis, and those cases which are called into being by the toxication from the renal inadequacy, or those which, existing perhaps latently as an hereditary predisposition, are intensified by the influence of the disease of the kidneys so as to become manifest. The latter classes of cases may be examined as to their mental condition, with a view of estimating as well the degree of failure of the renal function; while they are more yielding, the treatment of the underlying nephritis modifies the symptomatic mental condition. Joffroy (Le Bull. Méd., Feb. 4, '91).

Case in which alternation of coma with maniacal outbursts and with occasional delirium marked clearly the relationship between the ordinary manifestations of uræmia and conditions of alienism. The patient eventually recovered from all active symptoms. Remondino (Jour. of Nerv. and Mental Dis., Oct., '91).

Number of cases and statistics showing the frequency of nephritis in insanity. Bondurant (Jour. of Nerv. and Mental Dis., Nov., '92).

Affections of the kidneys are very common among the insane. Uræmic poisoning is one of the most frequent causes of insanity. Alice Bennett (Alienist and Neurol., Oct., '94).

[We doubt very much whether Dr. Bennett finds many followers in her confession of faith. We venture the prediction that, of 1000 cases in ordinary life, as many cases of kidney disease will be found as in the same number of the insane, if general paretics are excluded. We have made it a subject of careful observation for some years, and have not found the proportion of kidney lesions which Dr. Bennett appears to have observed. In the few cases of "grave delirium" which have come under our care this point has been especially examined with negative results, and the same may be said in the majority of instances of mental depression and anxiety. BRUSH, Assoc. Ed., Dept. of Mental Dis., Annual, '91.]

Mental aberration—illusions, hallucinations, general confusion, impairment of memory, aphasia, neuralgia, paralysis, etc.—connected with renal lesions. Bremer (Med. News, Oct. 20, '94).

A large majority of patients presenting retinal lesions die within a year after they are first discovered. Out of 419 of Bell's cases he found that 72 per cent. were fatal at the end of the first year and 90 per cent. within two years. Possauer reports that all men applicants at his clinics were dead within two years. Of the women 32 per cent. survived that period. It seems that among private patients only 59 per cent. of the men died within two years and 53 per cent. of the women. Edward Jackson (Medical News, Feb. 15, 1902).

Etiology. — Sometimes the cause of the slow, primary, diffuse degeneration, atrophy, and fibroid contraction of the kidneys is quite obscure, and in certain

cases it would seem to be "only an anticipation of the gradual changes which take place in the organ in extreme old age" (Osler), — the "senile kidney." Heredity undoubtedly plays a part in the causation of certain cases, and its influence has extended down through the third and fourth generations.

Age and sex also exert an influence, the disease being more common in males than in females, and usually beginning near middle life. It is rarely manifested symptomatically until the fiftieth or sixtieth year. A special tendency to sclerotic degeneration of the arteries, from whatever injurious influence, whether chemicotoxic or parasitic, renders the patient more prone to interstitial nephritis, though prolonged irritation by such agents may also cause the disease in persons whose cellular nutrition is usually not defective. Alcoholism, uric acid, and lead, giving rise to chronic poisoning, have all been assigned as causes of the disease.

Chronic malaria and syphilis also probably exert a causative influence.

Habitual overeating and overdrinking no doubt frequently cause granular atrophy and sclerosis of the organ, owing to the imperfect assimilation of the substances ingested and the constant excretion of irritating products by the kidney caused thereby. A wide-spread cause of the disease is the continuous and even moderate use of alcohol for many years; especially is this true in the case of spirituous liquors. It is just as probable that the excessive use of red meats in the diet leads to the production of the uric acid that induces the renal condition (uricæmia-lithæmia) by deranging the hepatic function (Murchison).

Gout may also cause chronic Bright's disease, and is allied to the above; this occurs perhaps more frequently in England than in this country, where lithæmia and nervous dyspepsia are more often seen.

Strümpell states that severe articular rheumatism is sometimes followed by contracted kidney.

> Chronic nephritis when met with in chlorotics depends upon an arterial lesion; patients affected with the two diseases are clearly descendants of gouty arteriosclerotic ancestors. Lancereaux (Bull. de l'Acad. de Méd. de Paris, p. 727, '93).
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> Appearance of great quantities of uric acid in the blood of nephritis not as constant as observations of Jacobi might lead one to think. Fodor (Centralb. für klin. Med., Sept. 7, '95).
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> The absorption of toxic substances from the intestinal tract plays the most important rôle in the etiology of chronic nephritis. The importance of this is very practically acknowledged by the range of dietetic treatment for the affection. The morning purge, colonic irrigation, and excitation of the intestinal functions generally, lead to prompt amelioration of the nephritic symptoms. On the other hand, serious nephritic conditions are ushered in by intestinal accidents. The first symptoms of uræmia or of kidney insufficiency are usually noted in the gastro-intestinal tract. The coated tongue, the nausea, the pain in the back, the oxaluria, etc., are all common symptoms of nephritis and intestinal disturbance. After the kidney function is lowered the liver-cells degenerate because of the presence of toxic substance; the liver then fails to metabolize substances that come to it, and adds its own quota of toxic material to the blood, which still further irritates the kidney. The vicious circle of influence thus formed continually deteriorates the general condition.
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> The inactive life of many city people is undoubtedly a cause for the development of toxic systemic products that irritate the kidneys. Almost invariably such people overeat, and this adds to the manufacture of toxins. In these patients the urine is often quite toxic when injected into animals. The basis

of these metabolic disturbances is often an atonic intestinal catarrh. This condition, however, is perhaps itself a manifestation of uræmic conditions. Constipation is a very uncertain effect. Though long continued in some people, it fails to produce any serious systemic effect, while in others its existence for a comparatively short time produces many and even serious symptoms. Coprostasis provides in the material detained in the intestinal tract a very favorable culture-medium for microbes. These not only produce poisons themselves, which are absorbed with serious effects, but they also consume normal food-material in the intestines and leave only degradation products to be taken up for the body-nutrition. These factors are especially active in the production of chronic nephritis, and the realization of this furnishes the best indications for treatment. A. R. Elliott (Proceedings Amer. Med. Assoc.; Medical News, June 21, 1902).

Anxieties, worries, and the high nervous tension required by modern business activity and by social life (the latter, particularly, in elderly ladies) favor the development of chronic Bright's disease. Associated with these causes are usually to be found an overindulgence in rich foods and sedentary habits.

The cold, moist climate of New England and the Middle States seems, to Purdy, to predispose to contracted kidney. Hydronephrosis, chronic pyelitis, and chronic congestion of the kidney (of cardiac origin, etc.) may cause a chronic productive nephritis without exudation, though never the true "contracted and red-granular" kidney.

Bright's disease is not primarily a kidney disease, but is really a circulatory disturbance. The brain and kidneys, the end-organs of the circulation, suffer most. It may well happen that death comes on from brain-lesion at a time when the kidneys are yet in reasonably good condition. Details of a case in which, by careful dieting and avoidance of extremes of temperature or other hurtful factors, the kidneys were spared, yet the fatal issue came through the brain. The brain is a very sensitive organ, and may show signs early in the case. The kidneys are insensitive, and may not react until late in the progress of the arterial changes.

The first symptoms of Bright's disease may be those of increased arterial tension. There may be, because of this, increased frequency of urination or occasional nose-bleed or persistent headache. A very early symptom may be functional gastric disturbance from increased blood-pressure. These gastric symptoms must not be confounded with the nausea and vomiting of later stages of nephritis. The prenephritic condition of Bright's disease may be detected in the irregularities of the circulation. These may give rise to clumsiness in the use of limbs or to actual paresis of one or more members. There may be temporary aphasia, and this symptom may recur several times, passing off completely in the interval. The earliest symptoms of Bright's disease if carefully looked for will nearly always be found in the brain. L. Faugères Bishop (Proceedings Amer. Med. Assoc.; Medical News, June 21, 1902).

Pathology. — The reduction in size and weight is about equal in both organs in genuine primary contraction of the kidneys. The two kidneys may together weigh not over two ounces, and they may be only one-half or one-third the normal size. They are frequently imbedded in thick, adipose tissue, and the capsule is thick, opaque, and very adherent; so that, on stripping it off, portions of the renal cortex come away at the same time. The outer surface of the organ is red, irregularly granular, or finely nodular, and occasionally small cysts are present. The tissue is firm, dense, and resistant to the knife. The cut surface shows a thin, atrophied cortex, with dark-reddish streaks alternating with pale portions.

The pyramids are darker than the cortex, and are also diminished. In the gouty contracted kidney they show fine striations of sodium urate or of uric acid, or crystals representing uric-acid infarctions. The principal changes are seen microscopically to be an increased production of connective tissue, especially in the cortical substance, and a more or less proportionate degeneration and atrophy of the renal parenchyma. The destruction of the latter is due to the circulation of noxious agents, but it is replaced by cicatricial fibrous tissue (Weigert). This new tissue is not uniformly distributed in the cortex, but appears in irregular masses around the shrunken glomeruli or between the tubules. In the pyramids the distribution is more general. The glomeruli are, in many instances, very small and fibrous in advanced cases; in the earlier cases the cells of the tufts and capsules are swelled and multiplied and a small-celled infiltration may be seen around the glomeruli and tubules. This cellular infiltration later becomes fibrillated and ends in thickening. The changes in and the growth of the capillary and intracapillary cells and of those around the tufts are partly responsible for the glomerular atrophy, as are also the capsular thickening and hyaline or waxy degeneration and the thickening and occlusion of arterioles. The tubules show decided changes, some being included in masses of connective tissue, with resulting compression-atrophy and even obliteration of the lumen. Others show constriction by the intertubular connective tissue, the lumen eleswhere thus being increased; this is especially prominent in the granules on the outer surface of the kidney, and little cysts may be seen here and there by the naked eye, as the result of damming back the urine in the tubules thus affected. The epithelium lining these tubules shows granular, fatty, or waxy degeneration, and may be either flattened, cuboid, or swollen in variety. The tubes may contain fatty or granular *débris* and tube-casts.

> In a former paper it was concluded that an actual physical alteration of the tissues is brought about by the toxic substances retained in the blood owing to the insufficient action of the kidneys. This alteration leads to œdema, on the one hand, and to a rise of arterial pressure, on the other, due to increased peripheral resistance. From this follows the hypertrophy of the heart.
>
> This theoretical view now confirmed by actual experiment. Physiological sodium-chloride solution was injected hypodermically in cases of nephritis without œdema, and it was found that the artificial œdema thus produced was not absorbed for from five to ten days, while if the same were done in non-nephritic cases, even when heart disease was present, it disappeared in a few hours, or in three days at the latest. This proves that the absorptive power of the subcutaneous tissue is much restricted in Bright's disease. Reichel (Centralb. f. inn. Med., Oct. 15, '98).

The growth of fibrous tissue in the walls of the arteries, causing sclerosis, forms an important change in most instances. The intima (endarteritis), media, and adventitia are all thickened by the hyperplasia of connective-tissue elements, and the arteries and capillaries are, in this way, mostly occluded by the obliterating endarteritis or by their conversion into connective tissue. Waxy or hyaline degeneration is also seen. These changes may sometimes form the primary condition that leads to granular and contracted kidneys, and may represent the renal effects of a general arteriosclerosis.

> In a case of interstitial nephritis terminating in cerebral atrophy, aneurismal

dilatations of the cerebral arteries observed, besides an hæmorrhagic area filled with fluid blood, which might have been taken for an aneurism, which was in reality due to rupture of the artery and successive hæmorrhages into the cerebral substances. Israel (Berliner klin. Woch., Jan. 29, '94).

Cardiac hypertrophy is an almost constant attendant upon chronic, non-exudative, productive nephritis, and its degree depends upon the extent of the renal, and also of the general arterial, degeneration and sclerosis. *Cor bovinum* has been applied to the organ, on account of its extreme size in this affection. The left ventricle only is hypertrophied in moderate enlargements.

Among the many complications of chronic Bright's disease may be mentioned cirrhosis of the liver, pulmonary emphysema, cerebral hæmorrhage, chronic endocarditis, endarteritis, pericarditis, and bronchitis.

Prognosis. — Chronic interstitial nephritis varies in duration, and in uncomplicated cases it may last for five, ten, twenty, or possibly thirty years. The duration may, however, be very much shortened by complications or intercurrent affections, or the condition may not be appreciated, as often occurs, when the post-mortem examination discovers the characteristic kidneys in one who had no symptoms of renal disease during life and whose death was directly due to some intercurrent affection. Life is destroyed sooner or later by this disease, unless the patient first dies from some intercurrent malady. Irreparable damage to the organs results from the gradual destruction of the renal parenchyma and its replacement by scar-tissue. The fact, however, that the process is slow and its duration, therefore, long allows a preservation of life for many years, and often with comparative comfort. The prognosis depends much upon the general condition of the patient, the cardiovascular system, and upon the presence of uræmia and inflammatory complications. A not far distant end is indicated by cardiac dilatation and insufficiency. Hæmorrhages, diarrhœa, persistent vomiting, nephritic retinitis, coma, and delirium render the prognosis exceedingly grave. Convulsive and apoplectic seizures are often fatal.

Hæmaturia, a frequent accompaniment of nephritis, is of grave import. Case of Bright's disease kept in comparatively good health by strict attention to diet and climate several years. As soon as hæmaturia appeared, however, he rapidly lost ground and died. Any appearance of blood, however slight, in chronic nephritis denotes an early demise. Dieulafoy (Jour. de Méd., May 10, '97).

Treatment.—A strict hygienic *régime* following an early appreciation of the disease will, to a considerable degree, prevent the advance of the cirrhotic process. Noxious substances that have an etiological influence must be removed as thoroughly as possible and avoided. Uric-acid formation must be reduced by dietetic supervision, alcohol must be interdicted, and lead—when the causative factor—must be prevented from further poisoning the system by a change of occupation. The heart and blood-vessels are also preserved by the diminution of these irritants. The hygienic treatment embraces a regulation of all the habits of the body and the mode of living. The malady is incurable; therefore the patient himself must be treated, and not the malady. A suitable dietary must be formulated for each individual, and Saundby's rule furnishes a good working principle: "Eat very sparingly of butchers' meat; avoid malt liquors, spirits, and strong wines." An absolute milk diet may be necessary for short

periods in the presence of gastric irritability, but undue weakness will be the result of a continued restriction to milk alone.

Restriction of dark meat is still advocated by many, owing to the larger amounts of extractive matter present, which is supposed to irritate the kidneys. According to personal accurate chemical analyses, however, the differences are so slight as to be of no practical value. When meat is roasted, a certain amount of extractive matter passes over into the sauce and this is more pronounced in the case of dark meat; so that beef-steak would really be more permissible than roast veal. T. R. Offer (Centralb. f. d. g. Ther., Sept. and Oct., 1903).

The drug treatment of chronic nephritis is likely to do good only in those cases which are primarily due to syphilis, malaria, or chronic suppuration. It is for this reason that diet is of paramount importance in the treatment of this class of kidney lesions. The author is, in a general way, in favor of a mixed diet. It is necessary to determine not only what the patient should take, but, what is more important, what he can take. The danger of starving the patient, in an attempt to keep down the quantity of albumin, must be borne in mind. Frequent blood examination will best show the development of anæmia. The author does not believe that white meat is more injurious than red meat. He is in favor of allowing the patient with chronic Bright's a liberal supply of fluid. Yet it must be borne in mind that such patients suffer from high arterial tension and that an excess of fluid tends to increase the blood-pressure. Each case must be treated as a separate entity and rule-of-thumb dietetics is always out of place. Anders (Amer. Med., Oct. 31, 1903).

A light, nourishing diet is, therefore, advisable. Lean meat may be allowed once daily in favorable cases, and vegetables, greens, fruits, and light, well-cooked, farinaceous articles may also be partaken of. Tea, coffee, and cocoa may be drunk. The use of the natural mineral waters aids in the renal circulation and keeps the kidneys flushed. As a rule, a mixed diet will be advantageous. The carbohydrate and nitrogenous elements (sugars and starches) should be used in moderate amounts, but fruits and pure fats are to be strongly recommended.

Von Noorden announces that in cases of contracted kidney and the early stage of heart-weakness the elimination of the products of metabolism is not influenced to any extent by a reduction of the amount of fluid taken daily. Albumin does not seem to be materially changed either by an increase or decrease in the amount of liquid ingested. Moreover, in Bright's disease, when the heart is failing, a diminution of the quantity of water proves beneficial. The reduction of the quantity of liquid is advised in the early stages. He has also noticed that after the ingestion of a large quantity of water in contracted kidney there is enlargement and weakening of the heart. In the advanced stages, with a corresponding degree of arteriosclerosis with hypertrophy of the heart, restriction of liquid is imperative. The average quantity of liquor advised is 2 pints. Professor Ewald confirms von Noorden.

The bath treatment was based on the assumption that the action of the skin had a certain connection with functions of the kidneys, and that by stimulating the former a disorder of the kidneys might be benefited.

J. M. Groedel (Practitioner, Dec., 1901) has never seen any curative results from the drinking of waters. His experience is that the bath treatment in cases of parenchymatous nephritis is contra-indicated. He divides cases of contracted kidneys into two groups. In the first group are those in whom the circulatory system is not greatly disturbed. The second group consists of those who show an advanced degree of insufficiency of the heart, which is more or less distinctly dilated. In the first

group of cases the Nauheim baths are suitable, but in the second group baths are contra-indicated. It has been said that carbonic-acid saline baths always increase the blood-pressure, but this is not the fact, and it has been proved that in cases of arteriosclerosis we are able to regulate the baths in such a way as not to increase the blood-pressure, but rather to reduce it. If this is the case, these baths should also be beneficial in contracted kidney. The baths of Nauheim have the effect of reducing the blood-pressure for a longer period than the artificial baths. The more carbonic acid the bath contains, the more the temperature may be lowered, but not below 90° F. The baths seem to dilate the peripheral vessels, a condition brought about by the irritation of the gas and the reduction of the blood-pressure; they lighten the work of the heart and lead to a saving of that organ, which gives it a chance of recovering strength, and this is still further promoted by the direct stimulating and tonic effect of these baths. The increase in the diuresis is ascribed to the strengthening of the heart. Editorial (Phila. Med. Jour., Aug. 23, 1902).

Persons that take considerable exercise may have considerably more food than those who are stout or who lead sedentary lives. Gastric disorders require a liquid diet until the digestion is restored, or the elimination of all but the soft and bland foods. All extremes of activity (bodily, mental, and emotional) are to be avoided.

After violent muscular effort, there is an increase in the quantity of leucocytes and epithelial cells normally found in urinary sediment, and likewise the apparition of cylinder-casts. Penzolt (Münchener med. Woch., Oct. 17, '93).

Physical exercise should be moderate and regular, and, if the climate be warm and dry, it should be taken in the open air. The patient should never be subjected to the vicissitudes of worry, anxiety, or to the tension of competition. Indulgences of whatever nature, if they tend to unbalance self-control or disturb the equanimity of the patient, must be strictly prohibited.

Often life may be prolonged by a change of residence to a warm, dry, and mild climate, since the variability and humidity of temperate climates, particularly during the winter season, tend to aggravate the disease. A sea-voyage or a sojourn at some southern European resort may be very beneficial.

Medicinal treatment is employed for the following indications: The bowels should be kept free by the assistance of laxatives or by laxative alkaline mineral waters. Papoid, peptenzyme, and other digestants, with bitter tonics, are useful in cases of furred tongue and indigestion. Acids or alkalies, according to their special indications, may also be used simultaneously.

High vascular tension is to be met by the cautious use of nitroglycerin in gradually increasing doses, beginning with 1 minim three or four times daily, until all danger of rupture of the vessels is over.

Among the first indications which suggest themselves considering the cardio-vascular conditions resulting from renal disease is immediate and free venesection on the occurrence of uræmic convulsions. Sixteen or twenty ounces of blood should be taken at once, followed by a calomel purge. If a single withdrawal of blood does not stop the convulsions it may be repeated, and recurrent uræmic convulsions may be met by further venesection. In acute tubular nephritis bleeding on account of convulsions may be followed by immediate and remarkable improvement.

A further indication for treatment may be deduced from the fact that the damage to the vessels and heart through which much of the suffering attending renal disease is brought about, and by

which life is shortened, is due to high arterial tension. The reduction of the intravascular pressure ought to be an object continually held in view. For this purpose the vascular relaxants have been tried: nitroglycerin, the nitrites, and the tetranitrate of erythrol. Unfortunately the effect of these substances is very fugitive; but the last named, which is slower and more persistent in its action, may sometimes be given with advantage. The best means personally known of exercising a definite influence on unduly high intra-arterial pressure is through mercurial aperients. A dose of calomel, 3 to 5 grains, will often avert impending convulsions or prevent their recurrence; will relieve the headache, stupor, and twitchings; and may prevent uræmic paroxysmal dyspnœa in advanced kidney disease. So also a single grain of pilula hydrargyri or hydrargyri cum creta, with rhubarb or colocynth and hyoscyamus, once, twice, or three times a week, according to the degree of tension in the pulse, exercises a favorable influence in the early stages of chronic Bright's disease, both on the symptoms and on the course of the disease. W. H. Broadbent (Practitioner, Nov., 1901).

The other extreme, of a very low tension that induces dropsy, and complications, usually uræmic (convulsions, dyspnœa, and headache) also call for therapeutic assistance. Headache, vertigo, and the so-called renal asthma (dyspnœa) are also often relieved by nitroglycerin.

Low tension, with scanty albuminous urine, œdema, and signs of dilatation, requires heart-tonics and stimulants, in conjunction with purgatives. Digitalis is effective, and especially in infusion, combined with strychnine nitrate or with caffeine citrate. The dropsy calls for calomel and the salines.

Uræmic symptoms are to be managed, as in acute Bright's disease, by means of free catharsis and profuse sweating, and occasionally by phlebotomy. In convulsions, severe headache, or dyspnœa, inhalations of amyl-nitrite or chloroform, or the hypodermic injection of morphine, $^1/_8$ grain, may be tried. When there is a probable malarial or syphilitic origin, contracted kidney may be benefited by the use of arsenic and the iodides, respectively. No medicaments, however, can ever transform the connective-tissue cells into secreting kidney-cells or restore the destroyed renal parenchyma.

To analyze thoroughly the results of treatment in Bright's disease one must have a clear conception of the histology and physiological functions of the kidney. Its complex pathology must be clearly understood. All the etiological factors must be given full consideration. The etiological factors are numerous and very complicating in their action. Only one, if any, of these can be reached by surgical intervention. Most of the etiological factors can be modified or removed by well-directed dietetics and therapeutics. Histologically speaking, Bright's disease can be cured. Physiologically speaking, the etiological factors can be modified, and often removed, the symptoms held in abeyance, while the renal glands perform their functions normally. Bright's disease is by nature an oscillatory malady, accompanied with frequent remissions and exacerbations. Remissions must not be mistaken for cures. Rational dietetics and therapeutics offer the largest possibility for a complete physiological cure. A well-regulated mixed diet, especially if composed largely of the animal class, when it can be tolerated, yields the best results. All therapeutics to be rational must be directed, not at the pathological lesion *per se*, but toward establishing a more perfect digestion and metabolism and a decrease in the work imposed upon the renal glands. W. H. Porter (Medical Record, Sept. 27, 1902).

The surgical treatment of Bright's disease seems to afford considerable hope as a source of relief and, in some cases, of

cure. "During the past year," says an editorial writer in the Journal of the American Medical Association, Nov. 15, 1902, "there has been a great deal of interest in this subject, particularly since the appearance of Edebohls's paper (Med. Record, Dec. 21, 1901), in which he claimed eight complete recoveries from various forms of chronic Bright's disease at least one year after decortication of the kidney. After report of such brilliant results several operators undertook the procedure, but with less satisfactory results than Edebohls reported. It seems certain, however, that operative measures relieve or cure certain cases of nephritis, and it is a highly-important question to determine just what classes of cases are suited for intervention.

"From a careful study of a series of 17 cases which he has operated on for various forms of chronic nephritis, Rovsing, Professor of Surgery in the University of Copenhagen, attempts to formulate some rules as to the proper treatment in such cases. He divides the cases into aseptic and infectious nephritis. In the aseptic cases he found that diffuse parenchymatous nephritis was not influenced by operation. A case which he classed as chronic glomerulonephritis recovered after operation, he believes, more from rest in bed than from any favorable result from the operation. In diffuse hæmorrhagic nephritis there is much danger in operating and the results are not satisfactory. In four cases of interstitial nephritis and perinephritis fibrosa occurring with uric-acid and oxalic-acid diatheses his results were satisfactory. Operation is frequently undertaken with a diagnosis of stone in the kidney in such cases and gives relief without any stone being found. The severe pains which are present in these conditions he believes indicate operation. Pain always indicates tension within the kidney capsule, it does not matter what form of nephritis exists. But the most important group of cases is that caused by some form of infection. Eight of his cases were of this character and the condition was only discovered after most painstaking examination. Urine obtained under aseptic precautions should be accurately examined chemically, microscopically, and bacteriologically, in every case, whether we suspect that we have to deal with an infection or not. In case pathological constituents are found, cystoscopy and catheterization of the ureters should be employed. In his cases Rovsing found infections of the urine from the staphylocccus aureus, staphylococcus albus, streptococcus pyogenes, and bacterium coli. The entire clinical picture did not differ in these cases from that in the aseptic forms of nephritis. Neither was there any difference in the chemical constituents of the urine or of the appearance of the kidney when it was exposed. The results of operation in these cases were very much more satisfactory, however, than in aseptic cases, and Rovsing believes that his cases show definitely that unilateral chronic nephritis may be of infectious origin; that it may affect a greater or smaller part of the kidney, or that we may have a double partial infectious nephritis. Stripping off the kidney capsule, which gives such favorable results in cases of aseptic interstitial nephritis with perinephritis and severe pain, also has a favorable influence on inflammatory processes. In hæmorrhagic cases he believes that splitting the kidney will give favorable results in the milder infections, such as by the bacterium coli, but it is dangerous in the more virulent infections. Resection of the diseased part in case of local infectious nephritis

which entirely resembled chronic aseptic nephritis led to cure in two of his cases.

"Further investigation is needed to prove the value of Rovsing's suggestions. Up to this time infection with ordinary pyogenic bacteria has not been considered such an important etiological factor in cases of chronic nephritis, though it might have been suspected that the cases following scarlet fever, erysipelas, and other forms of infectious disease were of this character. The careful study of this class of cases which Rovsing suggests, if carried out by competent observers, could not fail to give important results. If further study of such cases proves that we can find such definite indications for operation as are above suggested a great advance has been made and undoubtedly many lives will be saved. The skepticism of many surgeons as to the advisability of operating in every case of this kind seems warranted from our present knowledge, and, until definite grounds have been shown from more careful study of large series of cases by competent men, routine operation for chronic nephritis in any case cannot be considered an established surgical procedure."

By persevering effort the author has been enabled to see or get word from all the patients operated on by him, so that he could present the *status* up to date. The first renal decapsulation ever performed for the relief of chronic Bright's disease was done by him on June 10, 1892, and the patient was permanently cured. This case, together with reports of the five preliminary operations which led up to this procedure, was published in the Medical News of April 2, 1898. Subsequent papers giving reports of other cases of his own and a *résumé* of the work of other surgeons in this field were published in the Medical Record of May 4 and December 21, 1901, and of April 26, 1902. From 1892 to 1901, inclusive, the writer personally operated on 19 cases, and during the year 1902 on 32 cases. Of this total of 51 cases, 29 were in males and 22 in females, and the average age was 34 years. In 32 cases the Bright's disease was far advanced. In 41 of the cases the period which had elapsed between the first recognition of the disease and the operation varied from 1 month to 19 years. The general average of this period was $3\frac{1}{3}$ years, and in 32 cases it was fully 4 years. Nearly all the cases were attended by cardiac or other complications. Of the 51 cases, 29 were of chronic interstitial nephritis, and in all but 9 only one kidney was operated on; 14 were of diffuse nephritis and 8 of parenchymatous nephritis. If only one kidney was affected by Bright's disease, he said, the patient suffered very little, and the condition might be discovered only accidentally.

The chances of success for the operation are enhanced by the patient's remaining in bed for a week previous to it. This gives the heart a rest, if cardiac complications are present, and affords the best facilities for any preliminary treatment that may be required, as well as for systematic investigation of the quantity and condition of the urine. There are three conditions the presence or absence of which affect the facility with which the operation may be performed: 1. Great length and obliquity of the twelfth rib. This difficulty must be overcome by posture and a modification of the incision. 2. Obliquity or firm appearance of the kidney. When there is firm fixation it is generally necessary to incise the capsule at any point that can be reached. For separating the capsule the rubber-covered index finger is the best instrument. 3. The firm or more or less weak attachment of the capsule. Great caution and gentleness should characterize all attempts at decapsulation. In this operation there is often considerable danger of destroying some of the already diminished working tissue of the kidney, and it should never be performed except by surgeons who are

already more or less familiar with renal surgery in general. The danger is greater from the condition present than from the operation itself. The procedure, however, should not be too prolonged; so that one hour should be the limit for the decapsulation of two kidneys. The writer has often found half an hour sufficient for operating on both organs. A "team operation" has been proposed, with two surgeons each working on a kidney, but this would hardly be feasible, as two operators, each with his necessary assistants, would inevitably interfere with the prompt accomplishment of each other's work. Another expedient suggested is that only one kidney should be decapsulated at a time; but this too, is to be deprecated, as the time that the patient would be under an anæsthetic for two separate operations would necessarily be longer than for operating upon both kidneys during one period of anæsthesia. George M. Edebohls (Medical News, March 7, 1902).

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BROMIDE OF ETHYL.—Bromide of ethyl, or hydrobromic ether, is an anæsthetic prepared by combining bromine with alcohol in the presence of phosphorus. It was discovered by Sérullas, a French chemist, early in this century. It is an extremely volatile and colorless liquid, sweetish to the taste, and possessing an alliaceous odor. It presents the advantage over ether in not being inflammable. It is quickly eliminated from the system, and its after-effects are slight. Another preparation—bromide of ethylene—is frequently dispensed instead of the bromide of ethyl; it causes nausea when inhaled, and in no way possesses the qualities of the latter. Bromide of ethyl is, however, frequently found impure in the shops, and to this cause are due many of the untoward results met with.

Dose.—Bromide of ethyl cannot be used for prolonged operations, owing to its high volatility. The dose, which varies with the age of the patient, should not exceed 6 drachms. The administration of bromide of ethyl should not be prolonged beyond two minutes.

The operation may usually be begun twenty seconds after the first inhalation.

Physiological Action and Untoward Effects.—Bromide of ethyl causes death by arresting the heart's action, and the cases should be watched as if chloroform were being administered,—respiration and pulse simultaneously. The preliminary preparations for its administration are the same, and the recumbent position obligatory under all circumstances. Arrest of the heart may be caused, however, through vasomotor influence originating in an intoxication by compounds formed in the system.

Therapeutics.—Bromide of ethyl—as it causes muscular rigidity—should not be used in operations in which relaxation of the muscles would be of assistance. It also increases the chances of hæmorrhage.

Deaths from the use of the bromide of ethyl appear to have occurred chiefly some years ago before the sources of danger were understood. No death has been reported since 1897. The rapid anæsthesia produced by bromide of ethyl, its short duration, the quick return to consciousness, and the absence of unpleasant effects are very striking. The amount to be given at a single dose is from 10 to 30 grammes, and the drug must be pure; it is very liable to undergo decomposition through exposure to light or air. Most of the deaths reported have been due either to excessive dose or to impurity. It should be administered by means of a mask covered with impermeable cloth, so as to exclude the air. Unsuitable persons are young children and those suffering from anæmia, Bright's disease, fatty degen-

eration, and alcoholism. Vomiting occasionally occurs. One drawback of bromide of ethyl anæsthesia is that the muscles do not usually become relaxed. In mouth operations a gag should be inserted before the operation is begun. Huggard (Lancet, Sept. 12, 1903).

BROMINE AND ITS DERIVATIVES (BROMIDES, BROMATES, ETC.). — Bromine is a dark-reddish-brown, volatile fluid, emitting pungent and acrid fumes, caustic in action and taste. It is sparingly soluble in water (1 to 33), very soluble in chloroform, and likewise in ether and alcohol, both of which, however, it gradually decomposes. It combines freely with bases to form salts. As regards the bromates, the small proportion of bromine contained entitles them to consideration only in connection with their respective bases. The list of bromides is somewhat extended, there being no less than seventeen salts, and these, with half a dozen bromates and a number of other compounds, bring the total of bromine derivatives up to thirty-one. Some, however, are to be regarded as chemicals purely, or chemical curiosities, rather than medicaments, and a few are so rare or expensive as to inhibit general employment.

Bromide of ammonium is a white, granular salt that may, however, with exposure to light and air take on a more or less yellowish hue. Its action is practically the same as that of the potassium, sodium, calcium, lithium, and strontium salts, at least as regards the nervous system. It also, in small doses, is, to some extent, an alterative and hepatic stimulant; but in this particular is no better than, and perhaps not so active as, potassium bromide. It is the least palatable of the bromine salts, has a pungent, saline flavor (bromine taste), and is odorless.

Calcium bromide is capable of evolving 80 per cent. of bromine: a proportion greater than obtains to any other bromide; hence it has been lauded as a *succedaneum* for all the salts of alkaline base. It is had as a white, deliquescent salt, possessed of the usual pungent saline taste.

Lithium bromide presents much the same physical properties as the foregoing; is sharp and bitter to the taste, white, granular, odorless, and the most difficult of all the salts to keep, owing to its deliquescent character.

Potassium bromide appears as colorless, odorless, cubical, translucent, nonhygroscopic crystals of bitter, pungent, saline taste, and contains an average of 67 per cent. of bromine.

Sodium bromide exhibits a considerably larger percentage (77.5) of bromine than its potassic congener, and, though it has characteristic bromine taste, it is most palatable of all the salts, and the best borne by the stomach, though this latter claim has been disputed in favor of strontium bromide. It is a white, odorless salt, fairly permanent under all ordinary conditions of the atmosphere, and is found in the shops in two forms: as a granular powder and as small, monoclinic crystals.

Strontium bromide is a comparatively recent addition to the materia medica, and occurs in colorless, odorless crystals, only less deliquescent than lithium bromide, and possessed of the usual bitter, saline flavor; it contains 65 per cent. of bromine.

Bromal, tribromaldehyde, or tribromacetyl-oxide, is a limpid, colorless, oily liquid possessed of a peculiar, sharp odor

and irritating taste, obtained through the decomposition of alcohol by bromine; it is soluble in water, alcohol, and ether, but is not employed medicinally. Its derivative, bromalhydrate, however, was introduced with a view of affording an analogue of, and substitute for, chloral-hydrate, but has failed to secure the favor of medical men so confidently expected. It is a crystalline solid with the taste of bromal.

Bromalin, or bromethylformamide, contains only about half as much bromine as potassium bromide,—*i.e.*, about 24 or 25 per cent.,—and offers no advantages over the common bromide salts; hence requires little attention. It must not be confounded with *bromelin*: a preparation representing the digestive principle embodied in the pine-apple.

Bromamide is a synthetic body obtained by the union of bromine and formamide, and occurs in colorless, odorless, needle-shaped crystals insoluble in hot, but slightly soluble in cold, water, freely so in hot alcohol, and also in ether.

Bromol, or tribromphenol, like the preceding, is a synthetic product, had by the action of bromine on an aqueous solution of carbolic (phenic) acid; it is precipitated as silky crystals that are insoluble in water, but readily soluble in alcohol, chloroform, ether, glycerin, and fats.

The bromates can hardly properly be considered in connection with bromine and the bromides, since their therapeutic relations are markedly those that obtain to their base, hydrobromic acid excepted. The proportions of bromine are comparatively small as compared with bromides, though it must be admitted that their action as salts is, in considerable measure, different from that of their alkaloidal derivatives.

Preparations and Doses. — Bromine, external use only.

Bromide of ammonium, 10 to 60 grains.

Bromide of arsenic (Clemens's solution), 1 to 5 minims.

Bromide of barium, $^1/_{10}$ to 1 grain.

Bromide of cadmium, $^1/_8$ to $^3/_4$ grain.

Bromide of calcium, 30 to 90 grains.

Bromide of camphor (monobromated camphor; camphor monobromide), 2 to 10 grains. See CAMPHOR.

Bromide of ethyl (inhalation only). See BROMIDE OF ETHYL.

Bromide of gold, $^1/_6$ to $^1/_2$ grain. See GOLD.

Bromide of iron, 3 to 10 grains. See IRON.

Bromide of lithium, 20 to 150 grains.

Bromide of mercury, $^1/_2$ to 1 grain. See MERCURY.

Bromide of nickel, 2 to 10 grains. See NICKEL.

Bromide of potassium, 10 to 120 grains.

Bromide of silver, $^1/_4$ to 1 grain. See SILVER.

Bromide of sodium, 20 to 150 grains.

Bromide of strontium, 30 to 150 grains.

Bromide of zinc, 1 to 3 grains. See ZINC.

Bromal, 1 to 2 grains.

Bromalhydrate, $^1/_2$ to 5 grains.

Bromalin, 10 to 120 grains.

Bromamide, 10 to 15 grains.

Bromoform, anæsthetic and antispasmodic, 1 to 7 drops according to age.

Bromol, $^1/_{16}$ to $^1/_8$ grain.

Bromohydric acid, dilute, 2 to 120 minims. See HYDROBROMIC ACID.

Bromohydrate of caffeine, 1 to 6 grains. See COFFEE.

Bromohydrate of conine, $^1/_{30}$ to $^1/_{10}$ grain. See CONIUM.

Bromohydrate of quinine, 1 to 20 grains. See QUININE.

Bromohydrate of scopolamine, $^1/_{260}$ to $^1/_{100}$ grain. See SCOPOLAMINE.

Bromohydrate of strychnine, $^1/_{60}$ to $^1/_{20}$ grain. See STRYCHNINE.

Untoward Effects and Physiological Action.—Bromine, *per se*, cannot be administered internally because of its poisonous and powerfully corrosive properties. When brought in contact with organic matters it rapidly oxidizes and destroys them; hence its chief use is as a disinfectant (1 to 500); it also, sometimes, for like reason, finds employment as a topical application in hospital gangrene, phagedenic ulcers, sloughing chancroids, and like morbidities.

The common bromine salts are in a general way identical in action, the chief difference being intensity and palatability, which, of course, are determined by the amount of bromine each contains, and the character of its base. Potassium bromide is, perhaps, the salt best known and most generally employed, and a general description of its physiological properties may be considered as typical of the ammonium, calcium, lithium, sodium, and strontium salts.

Originally potassium bromide was introduced as an alterative and resolvent, and substitute for the iodide salt, and in small doses it often answers these purposes. But no sooner was its sedative action on the nervous system made apparent than its earlier uses were lost sight of, and to a degree that has practically buried all other properties in oblivion. It depresses the brain and spinal cord in medium doses, rendering the same markedly anæmic if pushed or exhibited in larger doses. If the doses are still further increased and continued, anæsthesia of mucous membranes of eye, throat, and nose is observed, which, doubtless, extends to the entire digestive and intestinal tract, though the evidences thereof are not markedly apparent in the rectum. Bromides diminish sexual desire, and, when pushed to the extreme of bromism, may destroy the same, or at least place in abeyance for a considerable period; at the same time the contractility of muscular fibre is diminished, and capillary circulation retarded. First of all the sensory columns of the spinal cord are depressed by bromides, next the sensory nerves; next the brain and motor columns of the cord; finally the motor nerves. While small doses do not seem to appreciably disturb the heart's action, larger ones depress, and, pushed to ultimate toxicity, death occurs with arrest in diastole.

Brominism is the first definite measure of toxicity, and, unfortunately, bromide of potassium and most of its congeners are eliminated very slowly; hence cumulative action. The cerebral symptoms are: a sense of mental weakness, heaviness of the intellect, and failure of memory; partial aphasia; great somnolence and depression of spirits (H. C. Wood). With these there may be decided impairment of sensibility of the skin, to a degree that considerable heat applied elicits no complaint (Peeche). There is usually violent frontal headache; but this often occurs ere the stage of brominism is reached; and bronchial catarrh and cough sometimes supervene. Where brominism assumes a chronic character, there is a nauseous, fœtid breath, congestion and œdema of uvula and fauces, disturbances of sensation as regards vision and audition, loss of appetite, and hallucinations either with or without mania. Routine prac-

tice in prescribing bromides may lead to mania.

The pernicious system of prescribing bromides recklessly for epilepsy and other nervous disorders may lead to severe mental diseases.

> When pushed, it produces apathy, listlessness, a total lack of interest in surroundings, a dull, sodden facial expression, and if carried still further a mental condition not unlike bromide poisoning. Toxic doses arrest the heart in diastole; the long-continued use of the drug results in a weakened and irritable condition of the heart and a general impairment of the circulation. Large doses depress respiration. The mucous membrane of the stomach is irritated, and the normal secretion of gastric juice checked. It causes constipation, a coated tongue, foul breath, loss of appetite, and not infrequently nausea and diarrhœa. Metabolic changes are lessened through depression of the nervous system, and tend to produce anæmia. Further, the drug often causes the well-known eruption. Bromide of potassium is to be used when overexcitement of nervous protoplasm is present, but never when the symptoms are due to depression. It is especially to be avoided in so-called psychical equivalent states. The writer has never seen a case of epilepsy cured by a bromide, but, on the other hand, he has seen it suppress epileptic phenomena while other forms of treatment were having time to produce changes for good of a permanent nature. W. P. Spratling (Ther. Gaz., June, 1903).

Paresis is often induced, with inability to walk, sometimes more marked on one side of the body than on the other and simulating hemiplegia; there may be failure of memory, going on to partial paresis, with involuntary movements of bowels and bladder. In a case of Jacksonian epilepsy, in a child, a drachm of potassium bromide was given daily. The father, a druggist, reasoned that, if this amount kept the disease in check, 2 or 3 drachms during the same period ought to work a cure. But the child speedily sank after the larger doses were instilled and became an imbecile. Also two children were taking bromide; one lost all memory of words and the other all idea of time.

Voisin, Stark, Kiernan, Moyer, Rockwell, Seguin, Spitzka, Alexander, and others have reported cases of convulsions arising from traumatic epilepsy that, under the influence of bromides, were replaced by *furor*. Cases of *grand mal* and *petit mal* have been reported in which their use rendered the patients unmanageable, violent, homicidal, querulous, irritable, and suspicious.

The last author quoted cites several more cases, eight in all. L. W. Baker, of Baldwinsville, three more. Laborde also observed priapism and sexual excitement sometimes amounting to satyriasis follow the use of bromides. Winters, of New York, has recorded many instances of visual hallucinations. Kiernan, of Chicago, and Numro, of Edinburgh, also observed marked aphrodisia. "That these untoward effects closely simulate the effect produced in epilepsy there can be no doubt, yet the weight of authority, and indeed the weight of evidence, is in favor of the opinion that these phenomena result most often from the suppression of epileptic explosions" (Bannister and Alexander).

"To give the bromides alone is to postpone the explosions and generally intensify them. The very fact that a sudden suppression of bromide administration is followed by a severe explosion is clear evidence that the drug acts rather like a load keeping down a safety valve." (Spitzka.)

Not the least unpleasant sequelæ—both as regards patients and medical attendants—that supervene as the result

Bromide of Potassium Eruption

ATLAS DE L' HÔPITAL ST. LOUIS

of continuous bromide administration, even in what are often considered very moderate doses, are the manifestations of brominism seen upon the skin. These may range all the way from a simple erythema to a rubeoliform or scarlatiniform rash, up to acne, pemphigus, furuncular swellings, and most foul and stubborn ulcerations that, too often, perhaps, are deemed evidences of a syphilitic diathesis. These are, for the most part, distinctly traceable to morbid changes in the sebaceous glands, in turn induced by impeded capillary circulation and obtunded nerve-fibrillæ. Such eruptions, if not recognized, are very annoying to treat, and are practically impossible to relieve until the bromide is suspended and in great measure eliminated from the system. It is claimed that the simultaneous administration of arsenic tends to inhibit such sequelæ; but this is not, by any means, universally true. The late Brown-Séquard was accustomed to combine belladonna with bromides, which frequently proves a most effective measure.

Case of a robust, well-developed child, 3 years of age, suffering from an ulcer on calf of leg, resembling a boil, covered at the apex with raspberry granulations bathed in adhesive, sanious pus. In a few days the ulcer was surrounded with acne pustules, which coalesced with the original lesion until the latter covered a large part of the gastrocnemius muscle; skin tawny or bronze; breath very offensive. The pustules were immense, and resembled varicella more than acne. Finally the sores threatened the whole leg below the knee. It was found the child occasionally suffered attacks of vertigo, for which a neighboring physician with a reputation for "curing fits" had prescribed large doses of ammonium bromide, under the supposition that he was treating a case of epilepsy. Fullerton (Memphis Med. Monthly, Oct., '97). (*See colored plate.*)

The evidence is overwhelming that the bromides are not the harmless medicaments that they are generally assumed to be; also that their present universal and routine employment should be abandoned for more rational and physiological methods of procedure. When a patient who has been taking bromides for some time complains of a salty or bitter taste soon after the drug has been ingested, especially if there is increased secretion of saliva, suggestions of fœtid breath, or a burning sensation in the mouth, whether accompanied by nausea and eructations or not, such should be regarded as evidence of impending bromism, and measures taken accordingly. It must be remembered, moreover, that these evidences may result from the administration of ordinary medicinal doses—10 to 20 grains in the adult—when frequently repeated, since the emunctories are not able to excrete this amount. Interstitial nephritis is a common sequel to brominism.

Of all the bromine salts, that of ammonium is the most apt to induce toxicity, since the effects upon the sensory portion of the spinal cord are most marked. Bromides of lithium, potassium, and calcium rank, respectively, second, third, and fourth as regards poisonous qualities. Collapse under either the ammonium or potassium salt may arise either through the base or the bromine constituent; but the potassium bromide is more apt to be at fault in this respect. It is sometimes a difficult matter to determine where the blame should rest; but withdrawal of the potassium bromide, substituting therefor another salt,—that of sodium, for instance,—may lead to definite decision. But the most innocuous (apparently) of bromine salts, when long-continued or pushed to extremes, are apt to induce

collapse; and fatal pathological changes in both kidney and liver have been ascribed to their use, with considerable reason and probability. Calcium bromide is claimed to be the least depressing, but this is not altogether borne out by long experience in its use.

> Case of infant, subject of a bromide eruption. Child when brought for treatment was 7 months old, irritable, and dentition was in progress. It was very feverish and would not sleep; stools were offensive. A simple carminative mixture was given, 2 grains of bromide of ammonium being added. Two days after commencing this, the rash appeared, and was well marked on the forehead, and there was an extension to the scalp and to some extent to other parts of the body. The child had been very greatly relieved by the treatment, although the rash was still well marked on the tenth day of treatment. Seymour Taylor (Brit. Jour. of Derm., May, '98).

Lithium bromide requires to be administered in larger doses than its congeners, and often proves the most irritating of any to the digestive system. The strontium salt is least disturbing to the stomach when continuously administered for considerable periods, and by many held the least likely to induce bromism; indeed, H. C. Wood believes it stimulates appetite and increases the activity of the digestive organs, which, however true of small and medium doses, at moderate intervals, is not a fact regarding medium doses with brief intervals long continued or larger doses. The chief advantage of the salt is that its base is practically non-toxic. Barium bromide may be dismissed with the statement that it offers no advantages over the other bromide salts, and it has the marked disadvantage of possessing a very poisonous base. It is also claimed for this salt that it stimulates mucous membrane, improves appetite and digestion, etc., and though this is, in a measure, true, such are referable to the metallic base rather than the acid source.

Sodium bromide is undoubtedly the most convenient, and to considerable degree the most safe of the bromide salts. Suitably diluted, it is no more disagreeable to the palate than the bulk of mineral waters, and it is, moreover, when accompanied by abundance of fluid, almost as readily eliminated. It must be remembered, in employing this drug, that it is not only essential, but of paramount importance, that the system be continually saturated, and flushed, so to speak, with water in abundance. Though some doubt its efficacy as compared with the ammonium, calcium, and potassium salts, it certainly is least depressing to both circulation and nervous system, and less irritating to the emunctories. In epilepsy it is questionable if the results desired are not those that accrue to toxicity rather than those of purely remedial character, for here free stimulation appears to inhibit prevention of paroxysms. But as a nerve-sedative purely, continued experience with sodium bromide invariably leads to increasing favor on the part of both prescriber and patient, until the verdict ultimately becomes overwhelmingly positive.

Bromalhydrate in large doses is a poison of great intensity, death rapidly resulting from paralysis of heart and sometimes of respiration also, preceded by minutely-contracted pupils, marked dyspnœa, and general convulsions. It lowers blood-pressure by powerfully depressing the circulation and vasomotor centres; it is equally depressant to the cord, especially the motor columns thereof. When employed in hypnotic doses, sleep is induced by direct action on the cerebrum, causing brain-anæmia.

Larger, but non-toxic, doses induce distinct lowering of body-temperature. Like chloral, to which it was expected it would prove an analogue, it is antiseptic; and it is likewise markedly and painfully irritant to mucous membranes and raw surface. It is eliminated by the kidneys but slowly, and in the form of urobromic acid.

Bromalin, inasmuch as it contains only about half as much bromine as potassium bromide, requires to be given in large doses, but its effects are supposed to be identical with the latter. It is claimed, moreover, that it is less prone to provoke unpleasant sequelæ; but clinical experience is not yet sufficiently ample to permit of drawing definite deductions.

> Bromalin used in two cases of well-pronounced bromine exanthema. Although complete disappearance of the exanthema was not brought about by the remedy, yet a favorable effect was exercised by the bromalin, which exhibited a more powerful sedative action than the potassium bromide previously used. Bromalin is the only remedy that perfectly replaces the bromides of the alkalies and that is almost entirely free from the by-effects of the latter. Böhme (E. Merck's Bericht, 1898).

Bromamide evinces its chief activity upon the cerebrum, which it materially depresses; hence its reputation as an hypnotic; nevertheless, it is inferior to many other drugs in this respect. In larger doses it is more markedly depressant, exerting its action upon the spinal cord, whereby it becomes an analgesic. In medium doses it stimulates the respiratory centres; but here, again, when pushed to the verge of toxicity, an opposite result accrues that may result in total paralysis. In small doses it influences the circulation but little; but in larger depresses the heart, and, if increased, the action of the organ is entirely suspended. Thus it is a remedy far more powerful for evil than good, and furthermore there is little confidence to be placed therein, since, once exposed to air and light, chemical changes take place whereby it develops greater toxicity. A dose taken from one container to-day that appears harmless, if repeated a week later may prove dangerous. Until more is known of the product, and until its manufacture and preservation can be encompassed by greater safeguards, insuring stability and uniformity, the drug is best relegated to the list of curious chemicals.

Bromoform is best known for its anæsthetic properties, but is sometimes applied to relieve the pain accruing to certain morbid ulcers, and here appears to be both an antiseptic and a local anæsthetic. After inhalation it may be detected in the form of hydrobromic acid in the urine. It is highly toxic, moreover, and induces symptoms of collapse, accompanied by great weakness, cyanosis, dilated and fixed pupils, and coldness of extremities, but seems to be easily eliminated from the system under the use of stimulants and tepid baths.

> Case of a child, 10 months old, that took by inadvertence about a drachm of bromoform. In a short time slight cyanosis had developed, the pupils were profoundly contracted and phenomena of respiratory and cardiac paralysis had made their appearance. The tongue presented a brownish discoloration, and the breath the characteristic odor. Artificial respiration was at once instituted, and the cutaneous surface was stimulated through hot bathing and cold douches to the head, the tongue meanwhile being pulled forward rhythmically. These measures were maintained for two hours, when an injection of ether was made. This was followed by trismus and spasms of the extremities. The injection was, however, repeated twice at intervals of

half an hour, and gradually improvement began to set in. Van Bömmell (Deut. med. Woch., No. 3, '96).

It is probable that in the system bromoform gives origin to chloroform. Rembe (Der Kinderarzt, viii, 49, '97).

Bromoform poisoning in a case of pertussis in an infant. The bromoform was given in a prescription with syrup of orange-peel, alcohol, and water. As the specific gravity of bromoform was greater than that of the other ingredients in the mixture, it naturally sank to the bottom of the bottle, and the mixture, in order that it be properly given, should have been thoroughly shaken before administering it. This not having been done, the bromoform precipitated, and must have been given in one dose in the last teaspoonful contained in the bottle. This showed the importance of prescribing this drug in its pure form, without the addition of any diluent. Louis Fischer (Annals of Gynec. and Ped., June, '97).

Simple formula for bromoform-and-chloroform mixture:—

℞ Bromoform, 18 grains.
Chloroform, 8 minims.
Rum, 4 fluidounces.

Whereas alcoholic solutions of bromoform precipitate in excess of water, this mixture with chloroform does not precipitate, no matter what are the proportions of water present. Gay (Jour. of Med. of Bordeaux; La Sem. Méd., No. 11, 1900).

Two cases of bromoform poisoning; the children found lying side by side, with breath smelling strongly of bromoform, with faces pale, eyes closed, pupils contracted, and limbs flaccid. Artificial respiration, brandy and strychnine hypodermically administered, and lavage with hot water and hot coffee brought consciousness in about one and one-half hours. Stokes (Brit. Med. Jour., May 26, 1900).

Case of bromoform poisoning in a child 16 months old. The points of especial interest were: The rapidity with which unconsciousness came on, and the corresponding rapidity with which the child returned to consciousness, after a period of over four hours; the pin-point pupils, which might have led to an incorrect diagnosis of opium poisoning. The bromoform administered to the child was not the last in the bottle, and therefore concentrated, as six fluidrachms remained in the ounce bottle after the second dose. H. K. Dillard, Jr. (Ther. Gaz., Apr., 1903).

Bromol has a peculiarly disagreeable, pungent odor, and a sweetish, astringent, but not unpleasant taste, and, as may be imagined from its derivation, is powerfully antiseptic. It is unfortunate it should have secured a designation that is likely to cause it to be confounded with bromal. It has been employed both externally and internally, but definite data are lacking regarding physiological properties when introduced into the living economy. Bearing in mind its source, it should, for the present at least, be regarded as a drug demanding great caution in its employment. It is said to be excreted by the kidneys as tribromphenolsulphuric acid.

Poisoning by Bromides.—It has repeatedly been denied that bromides *per se* ever induce fatalities, but the evidence already deduced is proof sufficient of their dangerous character. Careful examination of literature also reveals the fact that fatalities are, by no means, of infrequent occurrence, and the suspicion is forced that many deaths that should have been ascribed to the toxic action of bromides have been ignored or mistakenly ascribed to the malady for which the drugs were prescribed.

Hameau reports case of a young woman who took four and one-half pounds of bromide during ten months, and while in a condition of cachexia with yellowish skin, copper-colored eruption on forehead, colic, gastralgia, etc., suddenly became greatly prostrated; had delirium with profuse sweats, followed by death in four days. H. C. Wood ("Principles and Practice of Ther.," '94).

Case of a woman who took five pounds of potassium bromide in less than a year, and, while having very pronounced symptoms of brominism, was seized with delirium and suffered from hallucinations of sight and hearing; declared she was being poisoned. Death followed. Eigner (Wiener med. Presse, Nos. 25-34, '96).

A number of deaths can only be explained by the inordinate use of bromides. The patients sink into a condition of apathy from which they cannot be roused. Have seen three autopsies and have knowledge of five more wherein the excessive use of bromide salts gave rise to fatality. Janeway (Amer. Medico-Surg. Bull., May 16, '96).

Bromoform, owing to its kinship with chloroform, is an active toxic and its administration should be carefully watched.

In bromoform poisoning attention must chiefly be given to the heart and lungs. The heart is stimulated by injections of ether and camphor. As regards the respiration, the head should overhang, the mouth be kept open, the tongue drawn forward, and the mucus cleared out of the larynx. Artificial respiration and faradization of the phrenic nerves should be adopted. There is no specific antidote. Börger (Münch. med. Woch., May 19, '96).

Case of bromoform poisoning successfully treated by giving the child an emetic and an hypodermic injection of $^1/_{120}$ grain of strychina. The bromoform precipitated in the mixture and the greater part of it was consequently given in the last dose. W. F. Cheyney (Archives of Pediatrics, Feb., '97).

Treatment of Bromism. — This consists, first of all, in suspending the drug; next in promoting excretion by the emunctories, the kidneys and skin especially, coupled, if need be, with supporting treatment to heart and general circulation, and endeavors to restore to normal the *status* of the nervous system. The mercurial salts are often of marked value, especially the iodide as found in combination with arsenic in Donovan's solution. Occasional purges by large doses of calomel are also very effective, and, when given to the amount of 30 to 50 grains at bed-time, this drug is not only without depressing after-effects, but tends to stimulate the kidneys and emunctories to renewed activity.

Theoretically, pilocarpine, or jaborandi, would be considered of use; but to an economy already generally depressed, with circulation and nervous system suffering from the poison, these might prove boomerangs; atropine and belladonna are much more preferable and reliable.

Therapeutics.—The chief use to which the bromides, especially bromide of potassium, have been devoted is the treatment of epilepsy, but the weight of evidence tends to show that while they may decrease the number of paroxysms, they positively never afford other relief, and many times the condition resultant upon their use is worse than before treatment began. Again, at least 5 per cent. of epileptics cannot bear any bromide, even in small doses.

Use the three salts in epilepsy—ammonium, potassium, and sodium — in combination in doses of from 40 to 80 grains morning and evening. In strictly nocturnal seizures one dose at night only. Treatment should be persisted in for at least three years. Arsenic is a valuable adjunct to the bromides. Eulenberg (Ther. Monats., Nov., Dec., '92).

When a bromide is given in conjunction with borax the action is better than with either salt alone. Alexander (Liverpool Medico-Chir. Jour., July, '93).

Twelve cases of epilepsy: 8 male and 4 females, of ages ranging from 10 to 50 years; no predisposition, no syphilis. In 4 the fits occurred at least once a week, in the other 8 at intervals varying from 1 to 8 weeks. Bromide of strontium, 20 grains, with 5 to 10 grains of bromide of ammonium or sodium, were

given night and morning, largely diluted with water. Strontium increased rapidly to 60 grains twice daily when the smaller doses failed to control the attacks. The majority took the latter drug without any depression, but generally with the production of acneic rash on face. Fowler's solution of arsenic added to the mixture controlled the rash and increased appetite. The number of attacks in all cases was materially decreased, and in 8 there was no return after intervals of from 4 to 16 months. Roche (Med. Press and Circ., Aug. 12, '92).

It has been recommended to combine adonis vernalis and codeine with bromides in the treatment of epilepsy, but careful investigations on the part of many observers are not at all assuring in this direction.

The cures do not appear to be in any way effected save by the bromides alone, and the combination does not, in any way, prevent the complications and disagreeable symptoms which arise from the use of bromide salts. Taty (Lyon Méd., Dec. 29, '95; *ibid.*, Jan. 5, 12, '96).

Chorea. Convulsive and Paroxysmal Maladies. — The bromides have also been extensively employed in chorea, but without any great measure of success. They are, however, often most effective in hysterical seizures, asthma, the milder forms of whooping-cough and puerperal eclampsia and infantile convulsions; also have been lauded in tetanus, laryngismus stridulus, and seizure that sometimes follow thyroidectomy.

Stridulous laryngitis in children is, doubtless, due to inflammation of the larynx, the spasms being the sole danger. Here 60 to 70 grains of bromide of potassium should be administered daily, even to a child so young as four and one-half years; intubation or tracheotomy may be added in menacing cases. Huchard (Revue Gén. de Clin. et de Thér., No. 38, '94).

The excitability of the nervous system and convulsive symptoms that follow thyroidotomy may be diminished and suppressed by the use of potassium bromide. Gley (La Sem. Méd., Apr. 13, '92).

The symptoms of tetanus in dogs caused by total thyroidectomy can be overcome by large doses of potassium bromide; fifty animals operated upon were thus kept for two years, and two more for six years. Canizzaro (Deut. med. Woch., No. 184, May '92).

Bromoform has steadily been gaining favor as a remedy for pertussis.

Bromoform employed in 40 cases of pertussis with good results. For children, under 6 months, the daily dose is from 2 to 3 drops, for children of from 6 months to a year, from 3 to 4 drops. The daily dose should be administered in three portions. It is prescribed in an emulsion made of almond-oil, gum arabic, gum tragacanth, cherry-laurel water, and water. For the first two or three days the paroxysms of coughing may appear to be aggravated, but after the third or fourth a marked improvement is noticed. The remedy, however, is not uniformly successful. Marfan (Revue Internat. de Méd. et de Chir., Apr. 25, '96).

Results of treatment in 874 cases of whooping-cough, 832 cases being out-door patients, the remainder being seen in private practice. The drugs used internally were potassium bromide, tincture of belladonna, codeine, quinine, antipyrine, phenacetin, antifebrin, and bromoform. Bromoform acted better than any of the drugs, vomiting and other complications being almost unknown and the beneficial results being observed in from forty-eight to seventy-two hours. Eross (Jahrb. f. Kinderh., B. 42, H. 3 and 4).

About a thousand cases of convulsive cough at the polyclinic of Monaco treated with bromoform, all with most favorable results. In order to avoid all danger of poisoning, the adoption of a mixture with alcohol and glycerin is recommended. Mueller (Münch. med. Woch., No. 38, '98).

Heart Disorders.—In cardiac neuritis and in angina pectoris the bromides have been recommended, though it is admitted, as regards the latter malady,

that only excessive doses can be of benefit; in the former the most that can be expected is to obtund the reflexes, and this is equally true of their use in Ménière's disease and attacks of nervous vomiting.

In acute attack of Ménière's disease efforts should be made to subdue the excitability of the nerve-centres. Bromide of potassium, 10 to 20 grains three times daily, and rest in the recumbent position usually suffice to relieve. MacKenzie (Brit. Med. Jour., May 5, '94).

A girl, 8 years of age, of neurotic parentage, had curious attack of vomiting at intervals of about six weeks each; the vomited matter was highly acid, and there was a burning sensation in the stomach. Potassium bromide, and also chloral, per rectum, proved useful. Snow (N. Y. Med. Jour., July 1, '93).

Dysmenorrhœa. — Sir James Y. Simpson was wont to rely upon potassium bromide in connection with guaiac and magnesia for the treatment of functional dysmenorrhœa, and the sodium salt in conjunction with gelsemium has proved most beneficial in the hands of many. Bromides, too, are often of value in the casual forms of mental alienation that appear in very nervous females and are ascribed to the menstrual function.

There is an intimate relation between menstruation and insanity. The prognosis in menstrual insanity is favorable, and the treatment resolves itself into the use of general and ovarian sedatives, specially the bromides. Ball (Journal de Méd., Mar. 20, '92; Annales d'Hypnol. et de Psych., Feb., '92).

In four cases the administration of bromide of sodium induced erection and seminal emissions. The same drug produced orgasm in a girl; and in a boy suffering from seminal emissions as the result of masturbation the trouble was increased. Monroe (Med. Stand., May, '91).

Infectious Diseases.—Especially in the exanthemata and infectious diseases the bromides often prove of the utmost value if given in small and often-repeated doses, in allaying nervous excitement and combating insomnia.

Bromal has given good results in diphtheria when dissolved in glycerin (1 to 25) and applied topically to throat. Also internally in cholera infantum, in doses of from $^1/_{12}$ to $^1/_8$ grain. Rademaker (Lancet, London, Oct. 10, '91).

Reflex hemicrania from carious tooth relieved in three hours by a 15-grain dose of bromamide; premenstrual headache in like manner relieved in two hours. Relieves rheumatic pains. Best given in capsules, suspended in fluid, or dry on the tongue. Caillé (N. Y. Med. Jour., Feb. 20, '92).

Gout.—In some gouty people Brunton has found 20 grains of potassium bicarbonate with 10 to 20 grains of potassium bromide useful, taken when the feeling of irritability comes on. It frequently soothes, and, furthermore, has the effect of lessening worry even in those who are not irritable.

Brunton also finds potassium or sodium bromide and sodium salicylate of value in the irritability of temper that is sometimes a precursor of headache, and likewise in heart disease. But bromides are contra-indicated in the cardiac depression that accrues to an alcoholic or opium debauch, and moreover are most dangerous. Such are cases requiring bread and are offered stone; the already-depressed heart and nervous system demand toning up and stimulation, whereas the bromine preparations make the patient worse.

G. Archie Stockwell,
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BRONCHIAL TUBES, FOREIGN BODIES IN. See Respiratory Passages, Foreign Bodies in.

BRONCHIECTASIS.

Definition.—A more or less uniform dilatation of the bronchial tubes, of one

or both lungs, which may be localized or extend to the finer ramifications.

Varieties. — The dilatation may be *cylindrical,* involving the medium-sized tubes and, less frequently, the smaller bronchi and bronchioles, or *saccular,* the caliber of limited portions of the bronchi being enlarged, and forming bag-like cavities of various dimensions. "Bronchiolectasis" is a term proposed by Kanthack for those cases in which only the bronchioles are involved.

Symptoms. — In practically all the cases of bronchiectasis there is a history of prolonged bronchitis, of pleurisy, catarrhal pneumonia, broncho-pneumonia, or some other acute pulmonary disorder. A few follow the inhalation of some foreign body of sufficient size to occlude a bronchus. When bronchiectasis follows bronchitis, the symptoms of this disease assume a modified character: the cough becomes more severe and paroxysmal and the amount of expectorated material is greatly increased. This copious expectoration—which may reach over a pint a day—especially occurs early in the morning or after a sudden change of posture, even when the patient is in bed. At first giving off a sour odor, it gradually becomes fœtid, and this fœtor becomes so marked that the atmosphere around the patient is almost unbearable. In cases of long duration the expectoration is brownish and, when examined microscopically, is found to contain Charcot-Leyden crystals and masses or bundles of fatty-acid crystals. Various kinds of bacteria, leptothrices, etc., are also found, some of which are of external origin. The tubercle bacillus is seldom detected unless the patient be concomitantly suffering from tuberculosis of the lungs.

The temperature, which during the presence of bronchitis alone may have been normal or slightly above the normal level, now shows a tendency to rise near evening. The curve is irregular and may reach 105°. When the disease follows pulmonary disorders, attended with pyrexia, this is increased with the accession of fœtor. As a result of septic absorption, manifestations simulating those of hectic, as observed in consumption, usually occur, and the patient may succumb. Pulmonary gangrene is not an infrequent complication and promptly leads to a fatal ending in the vast majority of cases. Intense pain in the head in these cases indicates involvement of the meninges, while the cerebral pressure induced may give rise to hemiplegia, athetoid movements, and finally stupor. This complication occurs in about one-half of the cases.

In children the disease is frequently the result of whooping-cough or of broncho-pneumonia, the mechanical origin of the dilatation of the bronchi being mainly due to repeated and forcible coughing, the weakened resistance of the bronchi through inflammatory softening causing them to yield to the undue air-pressure. This is especially the case when inflammatory disorders involving the bronchi have repeatedly occurred in the patient. Cases of broncho-pneumonia or chronic bronchitis in which recurrences have repeatedly shown themselves are therefore the most prone to bronchiectasis.

When the cylindrical dilatation is not great, the physical signs do not differ markedly from those observed in the causative disorder. But a comparative point of value is that furnished by examination during a fit of coughing, when marked gurgling may usually be noticed, which gurgling varies according to the amount of accumulated secretion. Dur-

ing normal and even deep respiration increased roughness as compared to the ordinary signs of the primary disorder may be present; but the information thus obtained is not sufficiently distinctive to warrant for this symptom more than a confirmatory position among the signs present. Loud gurgling during coughing and fœtor of the sputum are conjointly, however, strong evidences that bronchiectasis is present.

When distinct saccular bronchiectasis is present, the characteristic signs of pulmonary cavities are pre-eminent, but most marked in the majority of cases at the base instead of the apex of the lung involved. Cavernous and amphoric signs are usually marked. The disease being unilateral in a larger proportion of the cases, confusion with tuberculosis is possible when the left side is involved, and when the bronchial dilatation is not confined to the base.

> In many cases in which the diagnosis is doubtful, or the auscultatory signs do not give reliable results and fail to localize with precision the bronchiectasic cavities, the Roentgen rays will reveal them on the fluorescent screen. A radiographic examination will, in most instances of multiple cavities, reveal the presence of all. Radioscopy, however, is not an absolutely infallible means of diagnosis. Tuffier (Bull. et Mém. de la Soc. de Chir., Mar. 6, 1900).

When bronchiectasis is due to the presence of a foreign body, it is caused by the violent cough induced, which gives rise to undue pressure within the tubes. The excessive coughing may also cause free portions of the lung to become dilated. The same condition may be brought about by stricture or compression occurring in the course of morbid processes which mechanically interfere with the free passage of air through the tubes. It may, in this manner, complicate phthisis and aneurism.

Diagnosis.—The conditions for which bronchiectasis is apt to be taken are pulmonary tuberculosis and circumscribed empyema.

Pulmonary Tuberculosis.—In this disease tubercle bacilli are usually found in the sputum. The lesions are located at the apex of either lung, generally the left; while in bronchiectasis they are more disseminated and involve the base. In tuberculosis there is a history of hæmoptysis, gradual loss of flesh and strength, and the cough is not inclined to be paroxysmal. This disease occasionally acts as the exciting cause of bronchiectasis, however, and the apex may be the seat of bronchial dilatation.

Circumscribed Empyema.—In this disease there is a clear history of acute onset, with pleuritic symptoms, and a sudden evacuation of large quantities of pus. The dyspnœa is not usually of long standing and generally comes on with comparative suddenness. Distinct dullness over the purulent area serves to indicate the true condition present.

> The data for forming a correct diagnosis are: *The sputum*, especially as regards *(a)* fœtor, *(b)* daily amount, *(c)* physical characters, and *(d)* method of expectoration. *Fœtor of breath* on coughing. *Physical signs of chest*, including the signs of cavities, especially in relation to *(a)* their size, distribution, occurrence, and symmetry; *(b)* their generally non-progressive character and daily variations. The temperature-range in bronchiectasis varies within very wide limits. It may remain normal for many weeks at a time, even when the sputum is offensive. On the other hand, it may conform to one of the remittent or intermittent types, with a range of as much as four or five degrees. T. D. Acland (Practitioner, April, 1902).

Etiology.—When chronic bronchitis is the primary cause of bronchiectasis the patients are usually past middle life,

with the exception of the form due to foreign bodies, which may invade the respiratory tract at any age. Dilatation of the bronchi is more likely to present itself during early middle life. As stated, it usually follows primary disorders of the lung, but it is most prone to do so in persons weakened by diathetic conditions or untoward habits. Under the former may be classed alcoholism, syphilis, gout, and rheumatism. Under the latter alcoholic conditions tending to mechanically induce an increase of the bronchial air-pressure by interfering with the free egress of the atmospheric current; laryngeal paralyses; laryngeal, infralaryngeal, and tracheal hypertrophic processes; neoplasms or aneurisms compressing the trachea or the larger bronchi; foreign bodies in any part of the inferior respiratory tract, etc., are as many possible causative factors. Exposure to cold and wet, dust, irritating gases, etc., tend to increase the local disorder by promoting the tendency to local congestion. Adenoid vegetations tend to predispose a child to the affection.

Prognosis.—Bronchiectasis being, as a rule, a secondary disorder, its prognosis depends, to a great measure, upon that of the disease acting as cause. Again, the degree of dilatation induced —whether it be cylindrical, circumscribed, localized, or diffused—bears an important influence upon the course of the disease. A slight modification of the bronchial lumen does not necessarily preclude the enjoyment of practically good health; when, however, the lumen of the tubes is markedly increased or studded with saccular dilatations, the infectious processes already described are apt to present themselves at any time and greatly aggravate the danger. Progressive emphysema and gangrene are among the complications to be expected. Dilatation and hypertrophy of the right ventricle is frequently observed in cases showing a history of pertussis. On the whole, well-marked bronchiectasis does not tend toward recovery.

A successful result is to be hoped for when appropriate measures are instituted at an early date—measures calculated to aid Nature's curative processes. This, of course, emphasizes the need of an early diagnosis, for, when fibrous replacement of the pulmonary parenchyma has occurred to any marked extent, a cure is seldom obtained. The expectoration then persists and fœtor recurs.

Pathology. — The bronchial tube in some cases is only temporarily dilated; this occurs in children after whooping-cough or acute pneumonic disease. It is far more common, however, when there has once been dilatation, to have repeated attacks of inflammatory trouble, and the dilatation continually increasing year by year. The effect on the bronchial tubes themselves is probably first of all swelling, sometimes observed in the mucous membrane, which becomes velvety in appearance; the muscular coat of the smaller bronchi then becomes tumefied and its resistance is weakened. Owing to the frequent attacks there is a considerable fibrosis or peribronchial thickening around these dilated bronchi. In some cases, however, instead of hypertrophy of the small tubes there is thinning and dilatation. When the bronchi are large this dilatation is very striking. On post-mortem are found large cavities with many valvular reflections of the mucous membrane,—an exaggeration of the normal condition of the bronchial tube; so that a large cavity seems to be partitioned off by these valvular septa, especially in the sacculated form of bronchiectasis; there is a small opening,

which is the bronchial tube leading to it. Not only are the bronchial tubes affected, but the surrounding area of lung is also involved. It is affected in two ways: First an extensive inflammation spreads from the peribronchial connective tissue, which is continuous with the whole frame-work of the lung. This tissue sends out delicate filaments between the alveoli of the lung, and this net-work is again continuous with the pleura and with the septa passing in from the pulmonary pleura. This frame-work becomes indurated, the chronic inflammation round the tubes continues until there is an interstitial fibrosis,—an interstitial thickening of the pulmonary substance round the dilated bronchial tubes. But such a lung with dilated tubes is especially liable to repeated attacks of catarrh or catarrhal pneumonia; therefore specimens sometimes show evidences of acute catarrhal pneumonia, but more often those of a chronic indurative pneumonia. The consolidation due to chronic pneumonia is distinct from the first, and is characterized by a reticular thickening, or fibrosis, of the connective-tissue elements forming the frame-work of the lung. The contents of the alveoli are in many cases consolidated, and the appearance is not of recent, but of organized, exudation. When stained with eosin and hæmatoxylin, the eosin picks out the blood-vessels. The centre of the alveoli may thus be shown to be filled with small cellular elements and small blood-vessels, indicating that it is becoming fibroid and organized.

As the disease proceeds there occur further complications, which end sometimes in death. In many cases ulceration of the bronchial tubes supervenes. In the bronchial tubes the retained secretions become putrid, full of micro-organisms, forming the foul sputum characteristic of such cases. Very often this goes on till ulceration takes place, and when once ulceration occurs any form of septic disease as a final cause of death may appear. Very common causes are found to be septic pneumonia and septic abscess in other parts of the body. Above all, abscess in the brain seems to be one of the commonest causes of death occurring in such cases. Besides septic pneumonia, death may take place from acute catarrhal pneumonia, especially where the patient has been subject to chronic bronchitis associated with rather frequent attacks of acute broncho-pneumonia. (Habershon.)

> Autopsy in a case of fibroid-lung bronchiectasis.
>
> Lung: Showing fibriod induration. The upper lobe is uniformly solid, gray, and very firm. The middle lobe is not so firm. The lower lobe is congested and shows an area of fibrous induration in the lower part. Extending through these solidified portions are tubular bronchiectasic cavities with blood-stained walls.
>
> Brain: Section through the right hemisphere of the brain about the paracentral convolution, in the upper part of which is an abscess-cavity the walls of which are irregular.
>
> The association of brain-abscess with bronchiectasic cavities has frequently been noted. Williamson has recently reported that out of 39 cases of brain-abscess, 17 were associated with putrid bronchiectasis. Livingood (Johns Hopkins Hosp. Bull., Dec., '97).

Treatment. — A very important point in the treatment of bronchiectasis is to see that the cavity or cavities are frequently emptied. This can generally be effectively done by partially inverting the patient, at first two or three times a day, and later once a day. The simplest plan to adopt is for the patient to hang himself over the edge of the bed or couch so that his legs rest on it and his

body is supported by his hands on the floor. This partial inversion is followed by cough and the evacuation of a considerable amount of offensive sputum. (Hector Mackenzie.)

> Quincke's suggestion of treating bronchitis and bronchiectatic processes by posture favored. In acute processes the measure is useless. In cases of fœtid bronchitis the relief obtained is marked. The posture is the dorsal one with the foot of the bed gradually raised by means of bricks. It is practiced morning and evening for an hour each. In fifteen minutes some result should be achieved; if no sputum is obtained by this time, the procedure is usually useless. In ordinary cases the entire day's secretion may thus be evacuated. O. Jacobsohn (Berliner klin. Woch., Oct. 8, 1900).

The above sufficiently illustrates the inadvisability of giving remedies such as narcotics to arrest the spasmodic coughing: a mechanical device employed by nature to rid the dilated areas of accumulated purulent liquids. The so-called expectorants are useless, and the disinfectant aromatics but serve to momentarily check the fœtor of the breath, whether applied by means of respirators or atomizers. The vapor or spray so produced hardly penetrates beyond the trachea. The medicaments employed must reach the diseased areas either directly or through the blood-current.

The intralaryngeal injection of antiseptic liquids recommended by Grainger Stewart accomplishes to a degree the desired result in the small proportion of cases in which the dilatation only involves the larger bronchi.

A drawback connected with methods in which professional dexterity has to play a rôle is that the patient does not always receive as many applications as his condition would require in order to obtain the best results. Measures which the patient can carry out himself are therefore always to be preferred.

A method at once beneficial and easily carried out is to resort to the prone position, as described above, and to administer drugs which are eliminated by the lungs.

The allyl compounds are very effective, and Vivian Poore has recommended garlic as especially valuable. A "clove" of garlic is to be chopped up and boiled in beef-tea and given three or four times a day. Hector Mackenzie found garlic most useful for diminishing the fœtor of the breath, and recommends in the case of children the syrup of garlic of the United States Pharmacopœia. A drachm of this may be given to a child three times a day with an equal amount of syrup of Tolu. For an adult 2 or 3 grains of powdered garlic may be given in a cachet, or 2 to 4 drachms of the syrup.

The balsams also possess curative properties, but do not reach the diseased areas when applied by means of the atomizer.

Molle has observed rapid improvement, amounting practically to cure, in children by the use of the following mixture:—

℞ Eucalyptol, 10 parts.
Creasote, 25 parts.
Tincture of benzoin, 50 parts.
Copaiba, 80 parts.
Oil of sweet almonds, enough to make 200 parts.

Thirty drops of this mixture are injected into the rectum, in a little milk, and the amount is gradually increased to one or two teaspoonfuls. One injection daily is sufficient. The child experiences a temporary burning sensation to which it rapidly grows accustomed. If this treatment is persisted in for months, all the symptoms are said to diminish, and the general condition is correspondingly improved, even proceeding to a cure.

The ordinary commercial coal-tar creasote is highly recommended by Arnold Chaplin, the aim being to empty the dilated tubes of the fœtid material and to prevent their becoming filled again. According to this author, and the argument is sustained by the excellent results obtained, in order to fulfill the qualifications given above, a drug is needed which, while it is strongly antiseptic, must at the same time be pungent and acrid enough to induce violent expulsive efforts. These conditions are, according to Chaplin, fulfilled by the common commercial coal-tar creasote. The mode of application is as follows: A room about seven feet square by seven feet high must be obtained, and this must be rendered tolerably air-tight. It is well to have the room on the top of the house, or away from it, as there will be less chance of the vapors generated from the creasote causing annoyance to those living in the house. In the centre of this room a small stand about 1 $^1/_2$ feet high is placed, and on this an ordinary spirit-lamp which admits of being raised or lowered. Over the spirit-lamp, on a tripod, an enameled-tin dish is placed, and into this is poured about half a pint of the coal-tar creasote. The creasote is heated until the dense pungent fumes are given off. The patient, clothed in an old dressing-gown, is placed in the room as soon as the lamp is lighted. As soon as the fumes begin to come off, an urgent desire to cough comes on, and soon the cough becomes more or less incessant, and attended with the expulsion of large quantities of phlegm. After the sitting has lasted from a half to one hour the patient may leave the room, and wait until the next day before taking another sitting. This should go on steadily from day to day for two months. For the first day or two not much benefit will be noticed, but very soon the expectoration becomes reduced and the odor less disgusting, and before very long the patient, who before was unbearable, is able to mix with his friends, and, unless he has a fit of coughing, his breath is quite free from smell. After two months the patient seems practically cured, but he must take a sitting at least three times a week if he will keep his expectoration free from odor. With the cessation of the fœtor comes increased appetite and strength.

Children do not bear the treatment well, and the benefit to them is not nearly so marked. The method is an unpleasant one, however, and it requires all the persuasive powers of the physician to keep the patient up to the necessity of going on with the application of the drug; but after a few sittings patients generally become used to it. Secondly, the fumes of the creasote produce running and smarting of the eyes and nose; but this can be prevented by introducing two plugs of cotton-wool into the nostrils and covering the eyes with a pair of glasses rimmed round with India rubber. Beyond these there are no drawbacks to the treatment, and it can confidently be recommended as likely to improve the condition of the patient if persevered in for sufficient length of time.

> Creasote found of much value, administered in the form of carbonate of creasote, $^1/_2$ drachm three times a day. Price Brown (Canadian Practitioner, Feb., '96).

Surgical measures have been resorted to with the view of reaching, by external incision and draining, the cavities containing fœtid accumulations. But the fact that the latter are very rarely localized within a restricted area

at once condemns so severe a remedy, that involves complications, especially pneumonia, which may soon cause the patient's death. The only kind of case in which it might in the least be warrantable is where the presence of but a single bronchiectasic cavity can absolutely be established by physical examination, and even then only when it is near the surface.

Two cases of bronchiectasis in which great relief was given during the paroxysms, and some more permanent benefit afforded, by placing the patient lying down on the bed the foot of which was raised twelve or fourteen inches. The immediate result in both cases was a great sense of relief, a diminution in the frequency and severity of the cough, a lessening of the sputum, a complete cessation of the gush of expectoration, and presumably the liberation of the affected pulmonary areas from entangling slime and from any further plugging with muco-pus. The postural method is also useful in contributing to the comfort and relief of patients suffering from general catarrhal affections with tenacious mucus, as well as in the later stages of pulmonary excavation in phthisis. William Ewart (Lancet, July 13, 1901).

In treating bronchiectasis the methods placed in the order of their efficiency may be classified, as follows:—

1. Inhalations of volatilized antiseptics: *(a)* creasote vapor-baths; *(b)* inhalations of creasote, oil of peppermint, eucalytus, etc.

2. Subcutaneous and intravenous injections of antiseptic fluids.

3. Internal medication.

4. Surgical treatment (incision and drainage).

The most successful means of relieving the fœtor, and occasionally, but by no means always, of lessening the amount of the expectoration, is the inhalation under certain conditions of crude creasote-vapor, as originally suggested by Dr. Arnold Chaplin. It is necessary to carry out this treatment systematically and thoroughly.

The details are as follows: A small room, free of any furniture except that of the simplest kind, and without hangings, is selected. It should have good ventilation provided mainly by means of a small fireplace, or in summer by means of Tobin's tubes. The patient should be provided with a comfortable wooden chair. On a small table is arranged an evaporating dish of the capacity of about half a pint, heated over a spirit-lamp. It is advisable not to consent to the use of a Bunsen gas-burner. Into the evaporating basin is put commercial creasote.

The creasote is slowly vaporized, and as the dense fumes begin to rise the patient commences to cough, and not only are the tubes cleared of the offensive secretions, but the deep inspirations which follow serve to draw the creasote-vapor into the smaller bronchioles, bringing it into immediate contact with the decomposing pus in the dilated tubes. A twofold object is thus effected: the cleansing of the tubes and the evacuation of their contents. It is in this combination that the creasote vapor-bath is more effectual than any other form of treatment. Until the patient becomes more or less accustomed to them, the fumes, which are very penetrating, cause a considerable amount of distress, and it is mainly the great benefit which is derived from the treatment which encourages patients to continue it.

The volatilization of a large amount of crude creasote makes everything in a mess, and the patient's clothes must be protected, and no ornaments or pictures must be left upon the walls. T. D. Acland (Practitioner, April, 1902).

Charles E. de M. Sajous,
Philadelphia.

BRONCHITIS.

Definition. — An inflammation of the mucous membrane of the bronchi, usually including the trachea. It occurs as a primary affection or as a feature of many general diseases, especially the exanthemata.

Varieties.—Bronchitis may be subdivided into four distinct forms: the *acute*, in which the inflammatory process is more or less severe, but of limited duration; the *chronic*, in which organic changes in the mucous membrane maintain the activity of the final stage of the previous form; the *fœtid*, which differs from the two previous forms by the fœtid odor of the sputa; the *fibrinous*, or plastic, which is characterized by the presence of pseudomembranous casts formed in the bronchi.

Capillary bronchitis, so-called, being in reality a form of catarrhal pneumonia, will be treated under PNEUMONIA.

Acute Bronchitis.

Symptoms.—The course of acute primary bronchitis is fairly uniform. After exposure to cold, wet, or, oftentimes, to a close atmosphere, there is a feeling of malaise accompanied by chilly sensations or, more rarely, a pronounced chill. Within a short time slight fever develops, and coincidentally with this or shortly afterward a feeling of constriction or oppression beneath the sternum, which is intensified by deep inspiration.

Cough soon appears, but is at first dry, harassing, and not productive of relief. The temperature is usually elevated by a few degrees, but in children may rapidly rise to 102° or 103° F. In the course of twenty-four hours the cough increases in severity, and by the end of that time is accompanied by the expectoration of a small quantity of glairy mucus produced only by inordinate effort. Gradually the cough becomes softer, the expectoration increases in amount and becomes opaque and finally yellowish. As expectoration increases the substernal discomfort lessens, the general feeling of illness diminishes, and the temperature falls to almost, if not quite, the normal point. After three or four days (sometimes sooner) the only symptoms remaining are frequent cough and a rather copious expectoration of yellowish-white muco-purulent material occasionally appearing as distinct clumps. The cough gradually lessens, the expectoration becomes less profuse, until finally the patient recovers completely after the course of a week or ten days.

In cases running a short course the mucous membrane probably becomes at once normal, although one attack of bronchitis frequently leaves behind it a certain susceptibility.

In children the initial general symptoms are more severe, the temperature elevation is greater, there is no visible expectoration until the fourth or fifth year, and vomiting is more frequent. Catarrhal pneumonia and atelectasis are frequent complications which may cause a fatal termination.

In the aged there is but little general disturbance at the outset, but the disease is apt to assume a subacute or chronic course, or the disease may end fatally in those enfeebled by advanced years or structural disease in other parts.

Physical examination in the early stages may show nothing or merely a few scattered sibilant râles. The respirations are slightly increased in frequency and a little more shallow than in health, except in infants, where the respiratory rate may be greatly increased. In the course of the first twenty-four hours there develop sibilant râles over areas on both sides of the chest, but especially in the spinal gutter. These râles rapidly shift their position and may be either produced or dissipated by the act of coughing. As the swelling of the mucous membrane increases or mucus is secreted in sufficient amount to materially alter the calibre of the larger tubes, sonorous râles appear. The out-pouring

of mucus in larger amounts causes the appearance of moist, mucous râles in addition. In the absence of involvement of the pulmonary parenchyma percussion gives negative results. Palpation frequently, especially in children, reveals a coarse fremitus, which may be found to disappear after free expectoration or vomiting. The occurrence of complicating pneumonia or atelectasis produces the signs peculiar to those conditions.

Diagnosis.—The diagnosis presents no difficulty except in the determination of the primary or secondary origin of the trouble. The chief difficulty occurs in children, where time alone may be able to decide the question as to whether the bronchitis is "simple" or is the premonitory stage of pertussis or measles.

Etiology.—The causes may be classified as mechanical, chemical, infectious, and toxic. Of mechanical causes are the inhalation of dust, particles of food, etc.; of the chemical as the inhalation of irritating gases (such as chlorine); of infective, that occurring in the course of measles is the most marked. Among the toxic causes the poison of uræmia and possibly that of some of the infections must be included, the latter upon the theory that the inflammation is produced by the excretion of toxins by the respiratory tract.

Exposure to cold and damp is an etiological factor probably acting by lowering bodily resistance and allowing the invasion of the mucous membrane by micro-organisms constantly present, but under ordinary circumstances impotent. The possibility of bronchitis being produced by the elimination through the respiratory passages of materials ordinarily passed out through the other emunctories cannot be certainly cast aside. Bronchitis has also been ascribed to the effects of ether, employed as an anæsthetic.

The infective nature of acute bronchitis has not hitherto been generally accepted. In health the great majority of observers find the lower air-passages sterile, the bacteria being withdrawn into the upper air-passages, chiefly by the nasal mucous membrane and the adenoid tissue of the pharynx. Jundell, for example, examining the tracheas by means of a special instrument, in forty-three people found it either quite sterile or else containing only scanty transitory bacteria.

Personal cases grouped in two sections:—

Cases of bronchitis without pneumonia 27

Cases of bronchitis with pneumonia 22

In all but 6 pathogenetic bacteria were found in great numbers.

Of these, those most frequently present were streptococcus pyogenes—found in 2 cases in pure culture, in 19 in association with other pathogenetic bacteria; diplococcus pneumoniæ—found in 15 cases of pure bronchitis and in 8 of bronchitis with pneumonia, and in these 23 cases in large numbers in all but 2, never in healthy bronchi; influenza bacillus—found in 17 out of 49, never alone.

Acute bronchitis is an infective disease, not due, however, to any specific organism; it is usually a mixed infection, the most important agents being the streptococcus pyogenes and the diplococcus pneumoniæ. The influenza bacillus not infrequently produces bronchitis apart from influenza. Ritchie (Jour. of Path. and Bact.; Practitioner, May, 1901).

Bronchitis is frequently caused by the extension of diphtheria and erysipelas from the upper tract, but in that case cannot be considered as simple bronchitis.

Pathology.—The mucous membrane is injected, of a bright-red color, is thickened, and thrown into longitudinal folds. The surface is usually covered with more

or less mucus or muco-pus. On section there is found leucocytic infiltration of the deeper layers. The epithelial layer shows active proliferation of the cells; goblet-cells are numerous and greatly distended; the cells of the mucous glands are swelled and granular; and the ciliated epithelial cells are seen to be shed in large numbers.

> The streptococcus bacillus predominated in all cases of bronchitis in influenza. In quite a number, and some of the worst, it was the only bacterium found in the expectoration. In 23 cases the streptococcus was associated with staphylococci alone; in 3 cases streptococci, staphylococci, and the influenza bacillus were associated; in 27 cases the streptococcus alone was found. The influenza bacillus disappeared after a short time, and was replaced by the streptococcus. F. Forchheimer (Med. News, June 1, 1901).
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> Many instances observed of localized bronchitis in which the sputum is crowded with diplococcus pneumoniæ. This suggests that these micro-organisms are the essential causal factor in a large proportion of such cases. This germ tends to affect localized areas in one or more pulmonary lobes and usually runs a benign course. There is also a tendency of recurrent attacks to implicate the same area again and again. P. W. Williams (Bristol Med.-Chir. Jour., June, 1902).

Prognosis.—In patients beyond the age of infancy and in those not debilitated by senility or serious organic disease recovery invariably occurs. In young children recovery is the rule; but the disease is of more gravity than in older children and adults, this gravity increasing inversely as the strength and age of the child. The chief danger in older children and in adults lies in the tendency to recurrence and consequent permanent change in the mucous membrane.

Treatment.—Treatment varies somewhat with the age of the patient. A few general directions apply to all ages. Equalization of the circulation and stimulation of all lagging emunctories are important early measures. In all cases purity of air, equable room-temperature (69° to 70° F.), and a slight excess of moisture in the air are essential.

In young infants the child should be clad rather more warmly than ordinarily, a cotton or woolen jacket should be applied, and the chest should be rubbed twice daily with camphorated oil or a mixture of equal parts of olive-oil and amber-oil or turpentine. A croup-kettle, to the water in which has been added compound tincture of benzoin (1 fluidrachm to 1 pint) should be employed for ten or fifteen minutes every hour or two, and in winter a broad, shallow pan of water should be kept in front of the source of heat in order, by its evaporation, to moisten the air of the room. Morrell has observed great benefit from inhalations of warm vapor of wine of ipecacuanha, ten minutes at a time, three or four times a day.

> The hot, dry chamber of the Turkish bath has been the means of aborting attacks of bronchitis, and deserves a trial; the patient to be driven in a closed vehicle to and from the bath, and with mouth and nose protected with woolen comforter. I am fully persuaded that the indiscriminate recommendation of the bronchitis-kettle is a great error; it has contributed to the deaths of not a few to my own knowledge. Alexander Duke (Med. Press and Circular, Feb. 3, '97).

Ordinarily in the early stage a simple fever-mixture with the addition of a small quantity of ipecac will be all that is required. Of the febrifuges the citrate of potash with or without the addition of small doses of tincture of aconite in accordance with the fever and cardiac excitement will be found useful and sim-

ple. After the formation of mucus has started and the fever has subsided the chloride of ammonium, in doses of $^1/_4$ to 1 grain, should replace the fever-mixture.

Ordinarily no further medication is required except for the use of mild laxatives to keep the bowels thoroughly opened. In removing the extra covering on the chest care is to be taken that the change be not made too rapidly, but that small portions should be taken away at a time. If at any time marked oppression of breathing occurs from accumulation of mucus, the production of vomiting by a full dose of ipecac will cause prompt clearing of the tubes. In feeble children stimulants may be required, and where the heart's action is weak the carbonate or aromatic spirit of ammonium may, with advantage, be used instead of the chloride.

Apomorphine, freshly compounded in acidulated mixture, is the best of all relaxing expectorants. In $^1/_{80}$-grain doses, at two or three hours' intervals, rarely fails to cause a free sero-mucous flow in twelve to thirty-six hours. Rest is an essential adjuvant. Codeine sulphate in $^1/_8$-grain doses, given independently, is the best sedative. Thomas Hubbard (N. Y. Med. Jour., July 18, '96).

In acute bronchitis of adults a combination of acetate of ammonium, spirit of nitrous ether, and ipecacuanha or antimony is commonly used, and no better combination can be employed. But an error is often made with regard to the dose of two of these substances. One should begin with doses of 3 drachms of the acetate of ammonium, and increase the amount to 6 drachms if the skin does not act freely. Spirit of nitrous ether may possibly act in $^1/_2$-drachm doses, but in doses of 1 to 2 drachms, especially when repeated at short intervals, it has commonly a very distinct effect as a diaphoretic. D. J. Leech (Practitioner, May, '98).

In older children and in adults a preliminary hot foot-bath, to equalize the circulation and start the emunctories, is of value. The application of mustard poultices or turpentine stupes to the chest certainly gives relief and probably hastens cure. The use of a cotton or woolen jacket is not so important as in infants, but is of value. In those beyond the age of infancy ammonia salts can be used earlier in the disease, the chloride acting especially well in combination with compound licorice mixture. Usually no other medicine, save possibly laxatives, is required unless the latter part of the attack is prolonged, in which case small and frequently repeated doses of the oil of eucalyptus, gaultheria, or copaiba may be given in capsule.

In the aged it is important to sustain the general strength and especially to watch the condition of the right heart. Stimulants are usually necessary; and it is important to change the patient's position at short intervals in order to facilitate expectoration and to avoid the effects of gravity in causing congestion or atelectasis of dependent parts of the lung. Many expectorant drugs other than those mentioned above are employed, but it is a question whether their action upon digestion does not offset any possible good effect upon the bronchitis.

The use of oxygen in inhalation is sometimes objected to on the ground that it is not a really curative agent. This is true, but the inference that it is not worth giving is believed fallacious. It does often remove cyanosis, and a continuous condition of cyanosis must be an evil. It is probable that the inhalation of oxygen is generally commenced too late. Belief that its early use prevents the advent of that pronounced cyanosis so often seen, and which, when it is once established, may be only slightly benefited by oxygen.

It thus gives patients an additional

chance of life, and, furthermore, in most cases it gives marked relief. If we objected to give drugs in ailments unless they had a direct curative influence, our use of the pharmacopœial remedies would be very limited. D. J. Leech (Practitioner, May, '98).

Yerba santa is extremely efficacious in the treatment of the second stage of bronchitis; it seems to diminish the watery and mucous constituents of the phlegm proportionately, so that this does not become more difficult of expectoration. The dose is 15 to 45 minims of the liquid extract. It forms a somewhat muddy mixture with water, but the addition of ammonium carbonate or bicarbonate of soda makes it clearer. Bronchial spasm in the course of the second stage of bronchitis is best treated with caffeine or iodide of potassium. F. H. Edgeworth (Bristol Med.-Chir. Jour., Sept., '99).

In children true asthma is very rare, and chronic bronchitis does not occur. Bronchitis often recurs, or may be prolonged, but it never becomes chronic. Emphysematous bronchitis is the most common form in children. There is always some dyspnœa, yet never marked asthmatic paroxysms. When a child has many attacks, his bronchi become distended from loss of elasticity. This bronchitis is commonly observed with the infectious diseases, and in rachitic, lithæmic, or tubercular children. From 5 to 15 drops of 1-per-cent. solution of iodide of arsenic thrice daily, with meals, has proved valuable in this condition. R. Saint-Philippe (Jour. de Méd. de Bordeaux, May 5, 1901).

Arsenic iodide is the best remedy in that form of infectious bronchitis which occurs in scrofulous children after grippe, measles, or whooping-cough. When taken with food it is said to be practically tasteless, easily digested, and well borne. The following formula is used:—

℞ Arsenic iodide, 0.3 gramme (5 grains).
Distilled water, 30.0 grammes (1 fluidounce).
Dissolve without the aid of heat.

Five drops of this solution are given in a glassful of milk with each meal, the dose being increased by 1 drop morning and evening until 15 or even 20 drops are being taken as a dose. The maximum dose is given for about a month, then gradually reduced to 5 drops, and this quantity is continued for a week, and then again increased as before. Saint-Philippe (Jour. des Praticiens, xvi, No. 16, 1902).

The following combination is useful:—

Syr. scillæ, 1 ounce.
Ext. lobeliæ fld., 1 drachm.
Tinct. opii, 2 ½ drachms.
Ext. ipecac fld., 15 drops.
Syr. pruni Virg., 1 ½ ounces.
Syr. picis liq., q. s. ad 4 ounces.

M. Sig.: One teaspoonful in water four times a day. (Jour. Amer. Med. Assoc., Jan. 31, 1903.)

Chronic Bronchitis.

Symptoms. — The onset of chronic bronchitis is usually insidious. It may follow immediately upon an acute attack which fails to subside or it may be gradual in its beginning, as in cases resulting from the long-continued inhalation of irritating material, such as metallic or crystalline dust or chemical vapors. Cough is the most prominent symptom. It is usually worse in the morning and after meals, but may give most trouble at night. It is usually accompanied by free expectoration of thick muco-purulent material of white, yellowish-white, or green color, at times twinged or streaked with blood. In a small proportion of cases there is no expectoration (dry bronchitis).

Cough and expectoration are for a long time the only symptoms, but in advanced cases (especially in elderly people) the right heart feels the strain of overcoming the increased tension in the pulmonary circuit, becoming dilated and causing circulatory embarrassment in the other organs (stomach, liver, and kidneys). Pulmonary emphysema, bronchiectasis, and asthma are the other

sequelæ encountered. Exacerbations are readily excited, obstinate, and prone to leave increased organic change.

Bronchorrhœa, so-called, designates but an exaggerated flow of the bronchial secretions. These may be more or less watery, mucoid, or muco-purulent. As much as six pints have been expectorated in one day by a single patient.

On physical examination but little may be found in the "dry" form. Otherwise the findings will depend upon the extent and duration of the disease and the presence or absence of its consequences upon the remainder of the respiratory apparatus. In uncomplicated cases inspection gives no result. On palpation a strong fremitus may be felt from the vibration of mucus within the air-tubes. The bubbling and rattling of this material may be audible at a distance. On percussion there is no change unless the pulmonary structure is already involved or bronchiectases have formed. On auscultation loud bubbling and mucous or sibilant and sonorous râles are heard, which shift their position or may be entirely dissipated by cough. Sometimes the breath-sounds over one portion of the lung may be feeble for a time from partial obstruction by mucus to the entrance of air. The diagnosis presents no difficulties if careful examination of the chest and of the sputum be made.

Etiology.—The chronic form is produced by the same causes as those mentioned under acute bronchitis acting for a longer time or frequently repeated. Insanitary surroundings, debility, and possibly inherited vulnerability are strong predisposing factors. Gout would seem also to be to some extent a predisposing cause. Mitral disease and enlargement of the tracheo-bronchial glands are contributing conditions because of their causing interference with the return-flow of blood and lymph from the bronchial tree.

Chronic bronchitis is very apt to be found in the two extremes of age. In children it may be associated with adenoid vegetations and enlarged lymphatics and hypertrophied tonsils. Among older persons the more common causes of chronic bronchitis, aside from lymphatic and scrofulous tendencies, are the gouty diathesis, insufficient action of the heart, emphysema, and asthma.

> Six cases of bronchitis and broncho-pneumonia caused, respectively, by chlorine-gas, sulphurous-acid gas, formaldehyde, kerosene-smoke, and smoke containing some unknown acid fumes. In the first three cases the irritants had only caused bronchitis, while in the last three broncho-pneumonia developed. The writer concludes that the above forms of bronchitis are much more painful in the beginning than the ordinary kind. They are likely to have loud, rough, wheezing râles, and, in the case of certain chemicals, fine, moist ones as well. This form of bronchitis may easily go on to a broncho-pneumonia. Hall (Phila. Med. Jour., Dec. 20, 1902).

Pathology.—The appearance of the bronchi differs much in accordance with the duration and severity of the disease. In the mildest forms the mucous membrane is of a dull-red or slate color, thickened, and corrugated longitudinally. In more severe or long-standing cases atrophy of the mucous membrane is present in places; and this atrophy may extend to the deeper layers of the tubes. Consequent upon this atrophy there is dilatation of varying degrees (see BRONCHIECTASIS). When all of the coats are involved, infiltration and fibrosis of the surrounding connective tissue takes place, giving rise to one variety of fibroid disease of the lung. In elderly people the cartilaginous rings

frequently undergo calcification, rendering the tubes rigid. Ulceration may occur, but is rare unless bronchiectasis has occurred or there is tuberculous or syphilitic infection. Other organs are involved secondarily, such as the right side of the heart (hypertrophy or dilatation) or the pulmonary structure (emphysema, fibroid disease).

Histologically sections of the bronchi show marked proliferation of the epithelial layer, or, in long-standing cases, great denudation thereof. New formation of connective tissue within the tissue proper of the bronchi and in the peribronchial connective tissue is seen to an extent corresponding to the duration of the disease. Commensurate with the fibroid change in the walls there is atrophy of the proper cellular elements.

Prognosis. — The prognosis depends greatly upon the surroundings and social condition of the patient. If removal from the chief causative factors (injurious occupations, unfavorable climatic conditions, etc.) is possible, the condition is curable except for possibly some permanent structural changes in the bronchial walls. Even with these the patient may be, to all intents and purposes, well. In the aged, in those already suffering from cardiac degeneration, or in cases with serious structural changes (bronchiectasis, emphysema) the outlook as to cure is unfavorable, and as to amelioration is doubtful.

Treatment. — The prime factor in treatment is the removal of the cause (insanitary surroundings, inhalation of dust, etc.). When the patient lives in a changeable or vigorous climate transplantation to an equable and mild region is of itself often sufficient to produce cure. Prophylactic measures to decrease the liability to exacerbations are important. The wearing of woolen underclothing, in order to prevent chilling of the surface; the practice of cool bathing on rising, in order to promote vascular tonus of the skin; the correction of nasal and pharyngeal anomalies in order to do away with any "weak spots" favoring the "catching of fresh colds"—these are important elements in treatment.

At times treatment of the bronchial condition is best carried out by treatment of systemic faults or of an existing cardiac lesion in combination with more direct treatment of the bronchial catarrh. In many cases an important element is the "building-up" of the patient. One of the most valuable drugs is strychnine, which acts as a general tonic and is particularly valuable in stimulating the respiratory centre and toning-up the muscles, thus enabling the cough to be more effectual. Its value in the aged is very great.

Expectorant remedies are certainly of value, yet it must be borne in mind that they are very apt to upset digestion. Among them the ammonium compounds occupy a leading place. Where the expectoration is scanty and the sputum viscid, the chloride is to be used; where the right heart is laboring, the carbonate acts best; when there is indigestion and especially flatulent distension the aromatic spirit is preferable.

Iodide of potassium is of great value in liquefying the sputum, while its absorbefacient properties may possibly diminish the hyperplasia in the bronchial walls. In gouty cases it is of particular benefit.

> Cases of bronchitis of many years' standing cured with ichthyol given internally in daily amounts of not less than ½ drachm. It should be administered in gluten capsules in order not to be freed

in the stomach. Le Tanneur (Bull. Med., Jan. 24, '99).

Encouraged by the favorable reports on the use of ichthyol in tuberculosis, grippe, etc., W. B. Jennings (St. Louis Med. and Surg. Jour.) began to use the drug in the common form of bronchitis in children which so often follows measles, whooping-cough, and acute, infectious diseases in general. He gives the histories of eight cases demonstrating the good effects of ichthyol in the above-named conditions. It was administered in the following combinations:—

Ichthyol, gr. xxxii.
Glycerini,
Spt. aurantii, of each, 3ss.
Aquæ, ad ℥ij.

The author gives the following conclusions: 1. The first dose often causes nausea and vomiting, but later the child grows inured to the taste of ichthyol. 2. Children under one year of age do not take ichthyol well. 3. To avoid the unpleasant effects of ichthyol it should be given after meals. 4. Increasing doses are not necessary for good results in children. (Merck's Archives, July, 1902.)

Case in a girl of 13, with bronchitis, of six years' duration, following pertussis, accompanied with dyspnœa, bloody expectoration, and spasmodic, violent coughing, which failed to improve on any treatment, including morphine, potassium iodide, creasote, belladonna, ipecac, sodium benzoate, bromoform, etc. She grew worse and had an attack of hæmoptysis. Then powdered ichthyol was given, 15 grains a day. The effect was marvelous. Cough and expectoration both disappeared rapidly and she quickly recovered. H. de Brun (Jour. des Praticiens, Nov. 29, 1902).

The balsams and various expectorant oils are of much value used by inhalation and internally. By inhalation they act directly upon the mucous membrane, while when given internally they exert their influence locally upon their excretion through the respiratory organs. The most useful are the compound tincture of benzoin and the oils of eucalyptus, gaultheria, sandal-wood, cubebs, and copaiba. For inhalation these drugs may be used on the Yeo respirator, in a croup-kettle, or in a nebulizer. Creasote is of value where the stomach will tolerate it. Menthol, used by inhalation, is an excellent expectorant, allaying the violent attacks of cough.

Topical treatment by direct inhalations from No. 65 Davidson atomizer, connected with an air-tank of about thirty pounds' pressure. The tip introduced into the mouth and the patient is instructed to make as prolonged an aspiration as possible, to inhale gently and repeatedly, drawing it into his lungs. Formulæ found most useful: menthol, 1 to 2 per cent.; creasote, 1 per cent.; camphor, $^1/_2$ to 1 per cent.; eucalyptus, 2 per cent.; pine-needles, 2 per cent.; in albolene or benzoinal. Average quantity to be inhaled is 2 drachms, after which the patients begin to gag. Kuh (Chicago Med. Recorder, Mar., '93).

The treatment of bronchitis divides itself into modification of the function of the bronchial mucous membrane so as to alter the secretion, and also with the object of combating congestion to facilitate expectoration, to calm the cough, and to improve the general health. The chief agents which, after absorption, are eliminated by the respiratory passages, consist in greater part of balsams, of plants containing essential oils, sulphur and its compounds, and the iodides. Of the first class in particular are tar, balsam of Tolu, benzoin, turpentine and terpine, eucalyptol, and creasote. The inconvenience attending all is that they exercise an irritant influence upon the stomach. Copaiba, though rarely employed, nevertheless is found to be very efficacious.

Turpentine is usually employed in capsules holding 3 or 4 minims, but terpine has quite largely taken its place. Creasote aids in getting rid of the secretion, and acts deleteriously upon tubercle bacilli. The balsams are usually employed by inhalation.

Eucalyptol may be prescribed in capsules containing 1 grain and given three or four times a day; it is preferable to turpentine as it is not so apt to produce disturbance of stomach and kidneys. Lyon (Revue de Thér. Medico-Chir.; Ther. Gaz., May 15, '97).

In the treatment of senile bronchitis strychnine and ammonium carbonate are in the first rank. In acute exacerbations of chronic bronchitis ammonium carbonate, in 5- or 10-grain doses, given in 2 or 3 ounces of milk, is of great service.

For chronic bronchitis and convalescence from the acute form, strychnine sulphate, in from $^1/_{40}$ to $^1/_{20}$ grain, every three to six hours, not only does quite as much as the ammonium salt, but, in addition, is a more powerful stimulant to the right heart. To disinfect the expectoration, creasote carbonate, in 20-drop doses, given in 2 ounces of sherry, repeated every four hours until purulency disappears, is effective. Ordinary creasote should never be given to the aged. With copious secretion and difficult expectoration this is the drug of choice. The use of opium or any of its alkaloids is most strongly condemned. Wilcox (Amer. Jour. of Med. Sciences, May, 1900).

Respiratory gymnastics, by increasing pulmonary capacity and accelerating the pulmonary blood- and lymph- circulation, are efficient. External applications to the chest-wall are of doubtful value in the absence of acute exacerbations and of pulmonary or pleural involvement. Systematic daily practice of full, deep inhalations of pure atmospheric air, and the judicious exercise of the deep muscles of the chest, are of great advantage. (Cassell.)

In bronchitis, as in the case of collections of pus, the object of treatment is to facilitate the draining away of the exudation. Often in the early morning the bronchitic brings up a large quantity of sputum by the help of more or less persistent coughing. At this time the patient should lie as flat as possible for a couple of hours, so as to assist the draining of the secretion into the large bronchi, and hence its expectoration. The patient can expectorate by turning the head to one side. After a few days the foot of the bed may be raised 8 or 12 inches. In suitable cases in two to four weeks there is a considerable diminution in the sputum. This mode of treatment is adapted to cases of chronic bronchitis which have led to a cylindrical or sacculated bronchiectasis in the lower lobes of the lung. It is of no avail in cases of diffuse, and especially recent, bronchitis, with general secretion, or in cases of abscess-cavities communicating laterally or incompletely with the bronchi, or of cavities with irritating contents. Quincke (Berl. klin. Woch., June 13, '98).

The diet should be nourishing and should be strictly regulated to the condition of the digestive organs. Excess of starches is to be avoided because of their tendency to cause flatulence and consequent mechanical interference with respiration. In cases associated with gout the question of diet is one of extreme importance.

Fœtid Bronchitis.

This form is only differentiated from others by the odor of the sputum. In many cases this is due to retention of the secretion in bronchiectatic cavities. (See BRONCHIECTASIS.)

Symptoms.—Fœtid bronchitis begins as an ordinary bronchitis, which later assumes the purulent form; or it may be ingrafted upon a chronic pneumonia, a bronchiectasis, or even a suppurative pleuritis that has perforated into the lung. The early symptoms are those of simple bronchitis. The pulse is rapid and there is continuous fever, but the temperature-record is usually irregular. The change to purulent inflammation may be marked by a chill or a succession of chills. Respiration is accelerated, and the severe cough causes the abundant

expectoration of an alkaline, semi-liquid, putrid sputum, which sometimes amounts to seven or eight hundred cubic centimetres per day. This sputum possesses an odor said to be quite characteristic of the disease, and resembling somewhat that of acacia-blossoms. The disease may terminate favorably, or it may cause death by the development of pneumonia, bronchiectasis, abscess, or gangrene. There seems to be no specific sign or symptom of the affection, unless it be the peculiar odor of the sputum, which Lumniczer claims is developed by the growth of the bacilli that cause the disease. (Whittaker.)

Death is generally due to exhaustion or through some intercurrent disorder kindred to the major affection.

Ulceration, ampullar dilatation of the bronchi, pneumonia, pleurisy, gangrene, and metastatic purulent deposits in other regions are the main complications of this stage of bronchitis. Abscess of the brain may thus become the cause of death.

Etiology and Pathology.—It is probable that in all cases retention of the secretion, with bacterial activity, is the cause of the fœtor. Leyden and Jaffé found small rod forms, to which they gave the name "leptothrix pulmonalis." They also noticed in the putrid sputum numbers of spirilla and infusoria. Lumniczer describes a short, somewhat curved bacillus, which he found in great numbers in the plugs of pus and *detritus* expectorated, which give the sputum its characteristic foul odor. More recently Hitzig isolated two species of bacillus, the one presenting the characteristics of the coli bacillus—short, thick rods—did not liquefy in gelatin; was found pathogenic for guinea-pigs and rabbits. The second did not liquefy in gelatin and was pathogenic for mice and guinea-pigs. This question may still be said to be *sub judice.*

Besides the causative factors acting in the case of chronic bronchitis, repeated exposure to dust, especially that originating from dyed woolens or cotton fabrics, is prone to lead to the fœtid form: a mere complication of those already described.

Treatment.—The agents recommended in chronic bronchitis are also valuable here, especially the balsams, terpine, turpentine, or terebene. Five to 10 minims of the latter in capsules, taken after meals, are very effective in most cases. The preparations of tar, already mentioned, are also valuable. In cases in which the fœtid expectoration only occurs at intervals, sandal yields gratifying results. Narcotics should be avoided. Hyposulphite of soda has been highly extolled; it promptly changes the character of the expectorated material and thus eliminates the fœtor.

Naphthalin is an excellent remedy in fœtid bronchitis. Following mixture may be given:—

℞ Naphthalin, 1 drachm.
Absolute alcohol,
Syr. of wild cherry, of each, 1½ fluidounces.
Fl. ext. of squill, 4 fluidrachms.
Tinct. of aconite, 8 drops.

Teaspoonful every three hours.

The following capsules may be also taken with the above:—

℞ Iodoform,
Calcium phosphate, of each, 24 grains.
Powd. ipecac,
Ext. of hyoscyamus, of each, 6 grains.
Powd. opium, 4 grains.
Oil of anise, 10 drops.

Divide into twenty-four capsules. One every three hours. Pirnot (St. Louis Med. Era, Sept., 1900).

Intratracheal injections have been rec-

ommended, the agents used—menthol, camphor, etc.—being dissolved in oil or albolene. A Pravaz syringe with a long curved tip, which may readily be introduced into the larynx, is used. Fifteen to 30 minims are well borne, and if properly applied excite comparatively no cough. Nitrate-of-silver solutions of varying strengths have also been employed, but one exceeding 10 grains to the ounce is apt to excite laryngeal spasm. Still, much stronger solutions have been employed with impunity.

Fibrinous, or Plastic, Bronchitis.

In this variety the secretion from the mucous membrane tends to form coherent casts of the bronchial tree.

Symptoms. — Fibrinous, or plastic, bronchitis is characterized by the occurrence of paroxysms of cough and dyspnœa, which immediately cease on the expectoration of the casts. The paroxysms are usually preceded and followed by a sort of catarrh. Hæmoptysis may be absent or it may be very serious. It usually ceases at once with the ejection of the casts. As a general thing, but little pain is present, except that caused by coughing. In acute cases the temperature may rise to 104° F.; in chronic cases it is seldom above normal. Sometimes the onset of an attack is marked by one or more rigors: suggestive of pneumonia. As a rule, each attack consists of a number of short paroxysms. It may subside after a few days never to recur again, or may last continuously for ten, fifteen, or twenty years. (West.)

Auscultation and percussion reveal signs similar to those witnessed in chronic catarrhal bronchitis, but they occupy a limited area like those of obstructed bronchioles; from time to time, intense paroxysmal cough occurs, accompanied with dyspnœa and cyanosis, ending in the expectoration of the pathognomonic sputa.

Etiology. — Although syphilis and tuberculosis have been considered as etiological factors, it is probable that these diathetic affections were probably, in the cases reported, but concomitant disorders—manifestations originating in local and general depravity. Indeed, in many cases no diathesis, inherited or acquired, could be discerned. There seems, however, to be a familial tendency to the affection, several members of individual family having suffered from it as a result of bronchial catarrh. This sufficiently indicates how obscure is our knowledge of the causes of this affection. Plastic bronchitis occurs frequently after pneumonia. In some cases it is associated with grave skin affections. There seemed in one case, also, to be a relation between the formation-casts and the catamenia. (West.)

> Analysis of all the cases recorded in the literature show that they can be grouped in nine classes as follows: 1. Chronic bronchitis with expectoration of branching casts of the bronchial tree. 2. Acute bronchitis with expectoration of branching casts of the bronchial tree. 3. Cases in which branching casts were not expectorated, but were found in the bronchi at autopsy. 4. Casts expectorated, but not showing branching. 5. Branching casts expectorated associated with organic heart disease. 6. Branching casts expectorated in pulmonary tuberculosis. 7. Small casts, often non-branching, associated with asthma. 8. Casts in the bronchi associated with pulmonary œdema following thoracentesis. Cases incompletely reported.
>
> The most important form is the first, and the results show that it occurs in either sex, increases to middle age, and then declines, and in several cases the patients were exposed to dusty atmospheres. Occasionally some infectious disease precedes the attack, or there

may be some chemical irritant, or a family history of tuberculosis. Nearly all the patients had suffered from chronic bronchitis for some time. The symptoms consist of an exacerbation of chronic catarrh. The disease is paroxysmal and may last for many years. The symptoms are dyspnœa, cough, occasionally slight fever, and very occasionally hæmoptysis. The physical signs are not characteristic, there may be all types of râles, and the patient may emaciate considerably. The subjective symptoms are usually oppression and tightness until the cast is expectorated. A curious feature is that in many cases there has been an associated affection of the skin. Of those casts examined the majority were composed of mucin. The bronchial mucous membrane usually does not show any characteristic change. In the acute form the symptoms are somewhat similar, but there is usually a history of an acute infectious disease. Bettman (Amer. Jour. Med. Sciences, Feb., 1902).

Pathology.—The casts may be found rolled up in the form of balls in the sputum. On mixing the sputum with water the casts are unrolled and may be spread out with needles. In some cases they are associated with Curschmann's spirals and Charcot-Leyden crystals. Bronchial casts are occasionally seen in croupous pneumonia, in diphtheria, and in hæmoptysis, but these casts are to be explained otherwise than as examples of fibrinous bronchitis. Eppinger has observed that in croupous exudation there seems to be a central condensed mass of exudate, which serves as a nucleus upon which are deposited successive layers of translucent fibrin. The mucous membrane is not infiltrated, as it is in a croupous exudation. Eppinger advanced the idea that on account of a chronic congestive catarrh of the bronchi the permeability of the walls of the vessels of the submucous connective tissue is increased and allows the fibrinogenous substance of the blood to escape. This transudation, moreover, is favored by the attenuated epithelial covering of the tubes: a condition that is the direct result of the catarrhal inflammation present in nearly all these cases. The exact cause of this cast-formation has not been definitely determined. That the casts are composed of mucus, and not of fibrin, has been definitely proved by Graudy. In a case in which the casts were expelled in great numbers Stirling found that the majority measured from 3 to 4 inches, some as much as 6 inches. They had evidently been deposited in successive layers and in concentric laminæ, which could be separated when dry. They consisted of coagulated albumin soluble in alkalies. They showed fibrillary material, in the meshes of which were numerous leucocytes and fat-globules, some hæmocytes, and epithelial cells. Octahedral crystals, said to be similar to those found in bronchitic asthma, have been observed by others, but the spirals seen by Curschmann were not found by Stirling.

Case in which the autopsy showed that the pseudomembranes extended from the posterior nasal outlets clear down to the third divisions of the bronchi. The only bacteriological element found was the staphylococcus. J. Glover (Anna. des Mal. de l'Oreille, du Larynx, etc., No. 5, '96).

Case in which the patient had suffered from the disease for some years, and was constantly expectorating bronchial casts. All the cover-slips from the casts showed streptococci; the inner surface showed micro-organisms of varying kinds, probably coming from the saliva. The disease due to the streptococcus; Marmorek's antistreptococcic serum used. After two months' treatment the patient was discharged much improved. The reaction to the antistreptococcic serum a further proof of the nature of

the disease. Claisse (Comptes-Rendus de la Soc. de Biol., Apr. 3, '96).

Histological appearances in the bronchi of a patient suffering from this disease who died of cardiac failure. Neelsen had found them to consist of mucus: a view which had hitherto met with no support. In this case the casts were found to consist apparently of fibres inclosing masses of leucocytes and large, swelled, round epithelial cells. Weigert's fibrin stain gave no coloration, thionin a faint pink; Curschmann's spirals were absent, this being the sole point of difference from Neelsen's results. The casts were thus composed of mucus, and not of fibrin. With regard to the bronchi, the epithelium was intact except in a few spots; Weigert pointed out many years ago that fibrinous exudates only arose where the epithelium had been shed over large areas. In the case under notice the goblet-cells were unusually numerous, and the glands had undergone mucoid degeneration, their ducts being filled with mucus. The origin of the casts was thus obvious. Graudy (Centralb. f. allgem. Path., vol. viii, No. 13, '97).

Examination of two cases secondary to valvular disease. Stained by Weigert's method, they showed very fine fibrin-fibres, most of the casts not taking any stain (lithium carmine.) Chemical examination also showed the absence of fibrin, but proved that the casts were made up chiefly of mucin. The casts were of acid reaction, and the writer thinks this is the cause of the coagulation. According to his view something, probably the action of bacteria, causes the bronchial secretions to become acid. The mucus then coagulates. The same explanation appeared to the casts sometimes expectorated in croupous pneumonia, and was able to confirm his view in a case of the latter disease. A. Habel (Centralb. f. inn. Med., No. 1, '98).

Case in which microscopical examination of the lungs showed a rather extensive tuberculosis of the pulmonary tissue, but no tuberculosis of the bronchi. In fact, the mucous membrane of the bronchial tubes was practically normal. In the pulmonary tissue a considerable quantity of fibrin was also present. Bacteriologically, only streptococci were found. Apparently there is desquamation from the alveoli of the lung, and masses of fat and epithelial cells are sometimes found in the casts. These conditions occur acutely and by a process analogous to that in cases of asthma: that is to say, as a result of desquamation itself, an exudation due to nervous influence, and a subsequent coagulation. The nature of the irritation is very various. Schittenhelm (Deut. Archiv f. klin. Med., B. 67, H. 3 and 4, 1900).

In the majority of cases of fibrinous bronchitis examined the clots consisted chiefly of fibrin, but in 7 out of 13 mucin was also present. Curshmann's spirals were only found once, and the hunt for Charcot-Leyden crystals and eosinophile cells was always negative. G. Liebermeister (Deutsch. Archiv f. klin. Med., vol. lxxx, Nos. 5 and 6, 1904).

Treatment.—The treatment does not differ from that of other forms of bronchitis except the fact that alkalies (potassium iodide and carbonate) and alkaline steam-sprays are of more decided value. The iodide of potassium acts by stimulating secretion and thus assisting in the elimination of the pseudomembrane. It must, however, be given in large doses.

Potassium iodide is probably the most useful remedy in all forms of the disease, as it increases the bronchial secretion when given during the acute paroxysm, and thus aids in expelling the casts. It also seems to lessen the tendency to recurrence of attacks if given in full doses and for a long period of time. J. W. Brannan (Med. News, Aug. 15, '96).

Creosote insures the best results in the treatment of fibrinous bronchitis. It should be given both during the attacks and during the intervals. For the relief of the suffocation in the acute stages, oxygen; steam inhalations, plain or medicated with an alkali; and co-

deine will be found of use. Moser (Med. Record, Aug. 6, 1904).

FREDERICK A. PACKARD and CENTRAL STAFF (Philadelphia).

BRONCHOCELE. See GOITRE.

BRONCHO-PNEUMONIA. See PNEUMONIA.

BRONCHORRHŒA. See BRONCHITIS.

BUBO. See SYPHILIS and URINARY SYSTEM.

BUBONIC PLAGUE. See PLAGUE.

BUCKTHORN (CASCARA).—The bark of the European buckthorn (*Rhamnus frangula*) and that of the Californian variety (*R. purshiana*), in spite of the interested claims of manufacturers, are practically identical in medicinal effect; if there is any superiority, it lies with *R. frangula*. Both require that the bark should be carefully gathered, dried, and allowed to lie for at least two years in order to get rid of a principle therein that is likely to induce griping.

The active (neutral) principle—"cascara sagrada," the source of the Californian bark—is supposed to be a glucoside, termed "cascarin," but this baptism is entirely superfluous, since it is identical with the principle found in the European bark, known as frangulin and xanthin.

Physiological Action. — Buckthorn and cascara are laxative, slightly tonic, and stomachic. If both are prepared and administered in the same way, the results will be found to be identical.

Preparations and Doses. — Abstract buckthorn (or cascara), 2 to 15 grains.

Extract buckthorn (or cascara), 1 to 8 grains.

Extract buckthorn (or cascara), tasteless, 1 to 8 grains.

Fluid extract buckthorn (or cascara), 3 to 45 minims.

Fluid extract buckthorn (or cascara), aromatic, 3 to 45 minims.

Cascara cordial, 1 to 4 drachms.

Elixir buckthorn, $^1/_2$ to 2 drachms.

Cascarin (or frangulin), concentration, 1 to 8 grains.

Therapeutics.—These preparations, to secure their best laxative effects, should be given half an hour after meals, and increased or diminished in dose, or repeated at lesser intervals, according to the action desired. In habitual constipation the best results are obtained by giving small doses at frequent intervals, thereby securing a continuous impression on the digestive tract.

BUNION. See TENDONS, BURSITIS.

BURNS.

Definition.—A burn is a high grade of acute inflammation, following the direct or indirect application of dry or moist heat to a portion of the cutaneous or mucous surfaces.

Varieties. — For ease of comprehension burns have been separated into grades according to their severity. The character of inflammation observed in these grades is governed by the exciting agent, its capacity for the absorption of heat, the duration of its contact, and the susceptibility of the part acted upon. Solid substances (copper and iron) and the fixed oils (olive and linseed) cause a greater impression than volatile (alcohol, ether, and chloroform) or aqueous (water and vapors) materials. Certain articles, owing to their tenacity (copper), although absorbing the same amount of heat as others (iron), cause more decided destruction.

The length of contact, giving in the shorter periods a superficial incineration

and in the longer a deeper destruction, is of importance in determining the grade of inflammation. The more dense and thick portions of the skin (buttocks, palms, and soles) offer greater resistance than those of thinner (face, neck, and abdomen) texture.

The effect upon the system will depend upon the character of person attacked, those of stronger constitutions being the more able to controvert shock than those of weaker frame.

A temperature, slightly increased above the normal (as, for instance, 100° F.), produces only a slight hyperæmia (first degree: dermatitis ambustionis erythematosa), which may disappear shortly after breaking the contact, while a rise to 150° F. will cause some appearance of vesicles and bulla (second degree: dermatitis ambustionis vesiculosa et bullosa) and destruction of the epidermis, the effect of which is not relieved for days after the removal of the burning substance, and yet, on the other hand, heat at the boiling-point of water (212° F.) may cause a complete carbonization of the part, resulting in the formation of eschars varying in color from a yellow up to a dark brown or black or, in other words, the production of gangrene (third degree: dermatitis ambustionis escharotica seu gangrenosa).

Symptoms. — The effects of a burn upon the body-structure are both local and constitutional. The former often results in great disfiguration or destruction of tissue, while the latter depresses the vital forces or terminates in death.

Local Effects. — In burns of the *first degree* the appearances produced are superficial. There will be observed a distinct hyperæmia with redness of varying intensity from the slightest blush up to a pinkish red or brownish red. This may or may not be entirely effaced by pressure. Persons of fair complexion or thin, delicate skin are affected more greatly by the same amount of heat than will be those of darker hue or more dense integument. Swelling is present to a slight degree and does not extend far beyond the limits actually exposed to the burning substance. This type of burn is produced by indirect contact with the flame of a lighted match, proximity to a heated metal, escaping steam, and the actinic rays of the sun.

With or without treatment the effect of burning to this extent may disappear shortly after removing the exciting cause. Resolution takes place in this variety by the disappearance of the swelling, the serous infiltration being absorbed, the color diminishing to the normal except in those cases in which a slight degree of pigmentation is left in the form of ordinary increase, which usually disappears as time progresses or where the sun's rays cause perhaps a permanent stain such as lentiginous patches. The linear fissures of the skin appear prominent because of the semidetachment of the membrane between them, which, as time passes, the new skin forming beneath compels their complete detachment in the form of minute flakes of deadened epithelium.

In burns of the *second degree* the inflammation, while yet superficial, may still occupy the entire epidermis. In some cases the upper layers alone of the cuticle may be destroyed, while vesicles or bulla may be observed over the affected surface. In still other cases the corium is stripped entirely of its epidermal covering or particles of the membrane may be rolled into whitish masses over its exposed surface. These vesicles or bulla may be produced directly by the contact of the heated article or indirectly by the consequent inflammation. They

may retain their contents or, owing to the increased flow of serum, their walls, becoming thin and losing their elasticity, rupture, thus allowing the escape of a continual discharge over the denuded surface. The true skin, which is exposed either entirely or at points, shows a highly-reddened surface, over which this continual exudation may be observed. The papillary vessels are seen to be deeply congested, or, if ruptured, their flow of blood intermingles with the discharge of serum and gives it a tint of red. Swelling is present in both of these conditions, but is governed by the extent of surface and the density of the part involved. In this type of condition actual contact with the heated substance takes place either in shorter or longer durations. Such articles as heated iron, transient or lengthened action of flames, and boiling liquids may be the exciting agent. The effects of this form of burn do not always show to what extent they have progressed immediately upon the removal of the cause, because of the systemic conditions which may be induced. Pain is always present to a minor or major degree.

Resolution takes place through coagulation of the serous discharge, which occupies the involved area as a fibro-albuminous covering, beneath which the new skin is allowed to form. After the new integument has progressed almost to its normal aspect this covering, which by this time has become a darkish crust, becomes loosened and falls off, exposing a thin, delicate skin, through which the more vascular structures immediately beneath are observed. It is not for weeks, months, or even years that the normal pinkish-red tint of the skin is restored. Burns of this character usually leave a fairly-normal aspect to the surface and rarely cause the formation of cicatrices. If a cicatrix is formed, it is generally superficial and flattened, resembling, to a marked degree, the flat, sebaceous warts observed in the aged.

In the burns of the *third degree* the inflammation or destruction may be superficial, extending over considerable area, or deep, affecting the subcutaneous tissues, muscles, and even bones. In those of the superficial variety the extent of surface-involvement may be variable, in one instance occupying a portion comparing with the size of the hand, and in others being observed upon portions ranging from six or seven inches to areas as large as one limb or even one-third or one-half of the surface of the body. In this variety the epidermis alone may be destroyed and expose the corium to view, covered with particles of charred cuticle, or the corium itself may share in the destruction, being deposited over the affected areas in strips of dried eschars. The parts uncovered by these destructive influences present, either the corium or subcutaneous tissue, a highly-vascular aspect, from which there is a continuous exudation of serum intermingled with the escaping blood. The dead tissues vary in proportion according to extent of heat, its length of contact, the thinness or density of the part involved, and the amount of surface encompassed. They may be thin or thick, large or small, and retain their hold for longer or shorter periods.

Resolution takes place in the uncovered variety in the same manner as described under the foregoing degree, while in the covered variety granulations spring up beneath the charred remains which, after a time, desiccate and fall off, exposing a similar surface to that of the second degree.

In the deeper form of burn the extent of surface involved may be small or

large, but may dip down to varying depths. It may be limited to the destruction of the skin (epidermis and corium) and the subcutaneous tissues, or it may expose the muscles, attack the nerves and blood-vessels (allowing hæmorrhage), and even the bone. The amount of charring will usually be very great and will lay about in masses over the burned surface, thus preventing a view of the destruction beneath. In some cases the degree of loss will be so enormous that the bone will be entirely stripped of all covering. Hæmorrhages will often be encountered and may result fatally. Fractures of bone will occasionally complicate matters. This variety will show both the first and second degrees at areas remote from the greatest destruction. Resolution even in the milder cases is slow, and before such happens surgical interference may be demanded. The same appearances may be noted throughout its process as found in the superficial variety, but to a different degree. The causes which bring about this form of burning are usually dry heat (flames or contact with electric wires), and it generally causes much greater destruction than will moist heat. The effect upon the system is generally of an alarming character, and shock may carry off the person before relief can even be attempted.

Electric and X-ray Burns. — Burns from electricity may be observed in all the varieties mentioned above. They may follow direct or indirect contact. Examples of direct contact are observed after handling live (charged) wires, and may be found to destroy all parts with which it comes into touch, or life even may be the forfeit.

Case of severe electrical burn in an electrician employed in the electric plant used to furnish power to the city street-car line and to the arc and incandescent lights of the city. The patient had accidentally brought his back in contact with the positive and negative keys of the switchboard of arc-line furnishing 96 street-lamps and carrying 4000 volts of electricity. He was released by the tissues' being burned away in two pits about three inches in diameter and down to the bony structures. The intervening space between these pits, which were ten inches apart, was roasted, and after the lapse of a few weeks was lifted out. It weighed two pounds and a half. The sloughing was such that the cotton, bandages, clothing, and bed were saturated with pus. Recovery. J. F. Weathers (N. Y. Med. Jour., Apr. 2, '98).

A most recent form of burning of the skin from the indirect contact of electricity is by the x-ray apparatus. Close proximity to the ray by either covered or uncovered parts result either in a superficial or deep inflammation of the skin. It may be observed a few hours after exposure to the rays or may be delayed for several weeks. Gilchrist, of Baltimore, in a case did not see any effect for several (three) weeks after exposure, while Crocker, of London, observed a case in which the effects were produced in one day thereafter. This form of burning attacks the skin alone in some instances, while in others the deeper structures, as the muscles, tendons, nerves, and bones (periostitis and ostitis resulting) are involved. The effects may remain for days, weeks, or even months after the application. X-ray burns are supposed by some to be produced by the action of the ray or by particles of aluminium or platinum reaching and being deposited in the tissues by others.

The x-ray *per se* is incapable of injuring the tissues of the patient, and the dermatitis, which has been called an x-ray "burn," is the result of an interference with the nutrition of the part by the induced static charges.

The patient may be absolutely protected from the harmful effects of this static charge by the interposition between the tube and the patient of a grounded sheet of conducting material that is readily penetrable by the x-ray, a thin sheet of aluminium or gold-leaf spread upon card-board making an effectual shield. C. L. Leonard (N. Y. Med. Jour., July 2, '98).

Burns of Mucous Surfaces.—The mucous surfaces may be affected by the inhalation of flames, vapors (volatile or boiling acids), boiling liquids (water, slacked lime), and by certain substances acting directly, such as ammonia and sulphuric and hydrochloric acids. The mouth, pharynx, larynx, bronchi, and the œsophagus, as well as the stomach, share in the attack. The eye often, from its exposed position, is the seat of burn. Conjunctivitis often results from irritants coming into direct contact with the eye, and if the exciting agent is not soon removed great destruction of substance or sight may be the result.

Constitutional Effects.—The effects of burns of the first degree upon the system are generally slight and are limited to pain, which disappears shortly after the removal of the exciting agent, but often may last for several hours.

In burns of the second degree the pain accompanies the phenomena not alone for hours and days, but often for weeks and even months. The shock may be of a transient character or of an alarming intensity. It may be encountered at the time of accident or be delayed for periods varying from hours to days thereafter. When small areas are involved, the depression may soon be relieved, but when one-fourth or one-third of the body is attacked death may intervene.

Burns of the third degree may be so severe that death intervenes before pain has time to appear. Shock at this stage is therefore observed early and of the worst character. Early mortality is generally due to the shock, while late mortality usually occurs during the stage of suppuration. Vomiting is often observed in both the second and third degrees.

Children suffer more from burns than do adults, and women more severely than men. The temperature is not affected by burns of the first degree, but is a marked symptom in those of the second and third. At the time of accident it may decrease from one to three degrees below the normal (to 97° or even 95°) and remain at that point until reaction begins, which is in about 36 or 48 hours, when it rises during the next 12 to 18 hours to 104° or 106° or more, at which point it remains for a period of 8 to 10 days (possibly rising and lowering at irregular intervals), when granulations, now in a fair formation, act as a retarding agent.

Six observations on burns of varying degrees of severity, in all of which glycosuria was present. The glycosuria is, as a rule, transitory, and is, in all probability, toxic in its origin, and connected with hyperglycæmia. When sugar is present after burns, the diet of the patient should be modified. Vannini (Ann. d. Mal. d. org. Genito-urin., June 15, 1903).

Complications.—The after-effects of burns may be concentrated upon the viscera (neural, thoracic, and ventral cavities) or directly upon the part affected (cicatrices, contractions, and fractures of bone). Burns of the first degree remain uncomplicated, while those of the second and third present many variations. The meninges (arachnitis following burns of the head), as well as the brain proper, may become congested or even highly inflamed, the sufferer presenting all the symptoms of restlessness and delirium, ending either in convulsions or coma. Tetanus is an early complication ob-

served. Bronchitis and pneumonia often result either from inhalations or indirectly from surface burns. Congestion in the kidney has been noted, with resulting albuminuria or hæmoglobinuria, while in many cases the urine becomes exceedingly scanty. Autopsies have shown rupture of the diaphragm and stomach, accompanied by contraction of the bladder. Amyloid degeneration in the viscera has been noted after prolonged suppuration. Inflammation of the gastro-intestinal tract with the formation of an ulcer (usually one, but more rarely several) of the duodenum (at its pyloric end) frequently occurs. This ulceration may begin early (four or five days) or it may be delayed for weeks, although, without the appearance of rectal hæmorrhage or perforation, with consequent peritonitis, we have no means of determining its presence. At times this inflammation extends to the colon and causes diarrhœa. Burns affecting either the chest or abdomen are the inducing cause, although severe burns at other points may produce them. Septicæmia, pyæmia, or erysipelas (the streptococci being found after death in the blood) may be the fatal ending.

Autopsies on the bodies of five small children who had died of severe burns: The most noticeable gross lesions were cloudy swelling of the liver and kidney, acute swelling of the spleen, and swelling and congestion of the lymphatic glands and other lymphatic tissue. Microscopically the most interesting lesions noted were parenchymatous degeneration of the kidneys and liver, focal areas of necrosis in the liver, and pronounced focal necrosis in the lymphatic tissue. The lymphatic tissue was affected throughout the body. The Malpighian corpuscles of the spleen, the tonsils, the gastric lymphatic follicles, the enteric, solitary, and agminated follicles, and the lymphatic glands, all showed essentially the same changes. The lymphatic glands were much swelled and at times congested. The earliest changes were in the follicles, and consisted of an œdematous swelling. This was more marked toward the centre of the follicle. In areas of less advanced alteration the lymphocytes were merely less closely packed together than is usual, but in the areas of more marked change the lymphocytes were swelled and their nuclei fragmented. The focal degeneration in the lymphatic follicles of the tonsil and of the stomach and in the Malpighian bodies of the spleen is essentially similar to that of the follicles of the lymphatic glands. In these areas of degeneration in the lymphatic tissue we find appearances essentially similar to those seen after the injection into the body of various bacterial and other toxalbuminous substances. The lymphatic glands from the cases of skin-burn might readily be mistaken for the lymphatic glands of children dead of diphtheria. The lesions in the other organs are also essentially similar to those found in the bodies of persons dead from acute infectious diseases. One of the main causes of death after burns, therefore, is in a toxæmia caused by alterations in the blood and tissues, the direct effect of the elevations of temperature. Bardeen (Johns Hopkins Hosp. Bull., Apr., '97).

The theories of the causes of death from burns may be divided into four classes: (1) death from shock or extreme pain; (2) embolism, thrombosis, and destruction of the blood-elements; (3) pyæmic infection through the burned surface; (4) poisons formed by the action of heat on the tissues, or autointoxication from deficient excretion by the skin. By experimenting upon dogs and rabbits it is personally claimed that the intoxication theory is the correct one. Injection of large quantities of artificial blood-serum subcutaneously appeared to save life in several cases. Azzarello (Giorn. Ital. delle Mal. Ven. e delle Pelle, fasc. 11, '99).

Two sets of experiments conducted to determine the influence of the skin in producing the poisons which lead to a fatal issue in burns, from which it is concluded that the blood itself, rather than

the tissues, is the seat of the chemical change. E. Scholz (Münchener med. Woch., Jan. 30, 1900).

1. The entire pathological picture presents great similarity to the conditions found in the diseases characterized by the presence of toxins of bacterial origin in the blood.

2. Damage to the lymphatic tissue is a constant feature, but is not necessarily focal, some cases presenting only diffuse degeneration. The cases which live but a few hours after infliction seem more likely to present a focal condition than those which live a longer time, as the condition which the writer interprets as proliferation and phagocytosis is one which may very rapidly disappear.

3. The focal lesions are not a true necrosis, but rather a proliferation of the endothelial cells of the reticulum and the capillaries, and a phagocytosis by the leucocytes and endothelial cells, to which latter is due the fragmented, disintegrated appearance which suggests a true necrosis. John McCrae (Amer. Medicine, Nov. 9, 1901).

The attempt of nature to restore a covering for these denuded tissues often results unwisely. Vicious scars, adhesions of contiguous parts (causing webbed fingers, the arm being attached to the side by granulations), and deformities may be encountered. Cicatrices may be small and flat or large and rugous. The skin may be as soft and pliable as in the normal state, or tightly stretched and drawing the parts from their anatomical position. Calcareous degeneration or even epithelioma may attack the scars. Pressure upon the terminals of the nerves may either cause neuralgia or spasm of the glottis, which may demand surgical interference for its removal. Finally, keloidal tumors may be observed as a consequence of vicious scarring. They will not differ from those produced by other abnormalities and will accept all the gyrations encountered in other conditions. All of the scar may not be affected with keloid, as, for instance, one end may show the prolongations, while the other resembles ordinary cicatrices. The contractions of the skin after scarring may produce great deformity and the hand may be drawn backward upon the arm or talipes calcaneous may result or other disfigurations too numerous to mention may be shown. Exposure of joints has taken place followed by ankylosis. Bones have been fractured from loss of substance (cooking of the muscles).

Diagnosis.—Ordinarily the recognition of burns is not a difficult task, although the differentiation of the varieties, especially of the second and third degrees, may demand careful examination. Burning flesh with destruction of its particles, exposure of the underlying tissues (muscles, bones, etc.), will be a train of symptoms not to be controverted. The difference between burns and scalds often may occasion difficulty, but the fact of the greater and deeper destruction of the former with the more superficial character of the latter will generally be sufficient. The loss of hair follows the former because of this deep destruction of the hair-follicle and papilla.

Legal aspects of burns. In cases where the persons have been alive when they were exposed to the fire, soot is found in the ramifications of the trachea and bronchi. If the red blood-corpuscles are found disintegrated and disfigured throughout, then this is a further sign of a person having been burnt while alive; the blood of animals which have been burnt or scalded after death shows only occasionally a few broken-up, crenated, or polymorphous red corpuscles; as a rule, the red blood-corpuscles retain their shape and integrity, and appear only swelled and paler. Robert Neupert (Friedreich's Bl. f. ger. med. u. Sanitætspol, vol. xlviii, pt. 3, '97).

The diagnosis of death from burns cannot be made solely from the external appearances. Blisters which are not filled with serum arise during life. Bright-red blood of charred corpses arises from the direct physical action of the heat and from the production of carbonic-oxide hæmoglobin. The presence of carbon monoxide in the blood is an almost positive proof that the person during life was not exposed to the influence of fire. The finding of soot or charred material in the respiratory passages is certain evidence that the individual was living and breathing during and in the presence of a fire. Lipkau (Deutsche med. Zeit., Aug. 13, 1900).

Pathology.—The condition immediately following a burn is that of diminished blood-supply to the part attacked. This seems in part to be due to the decreased size of the vessels, probably following a spasm of the vasomotor system. As the blood is prevented entrance into the smaller blood-vessels there is a consequent engorgement of the viscera, with actual congestion or even inflammation of their mucous linings. The process does not end here, but we note a change in the corpuscular elements of the blood itself; the lumina of the blood-vessels are decreased, which allows the formation of thrombi with more or less complete general stasis and possibly resulting in a cardiac paralysis. This overstimulation of the mucosæ may account for the degenerate changes which have been observed in the abdominal viscera, ending, as stated, in the formation of ulcerations of the duodenum or which have caused the extension of the inflammation to the colon and terminate in the production of diarrhœa and hæmorrhage. Thus the mode of death is apparently due in some cases to the formation of pulmonary thrombi which occasion this paralysis of the heart. Other cases probably end in narcotic poisoning from absorption of the dead epithelium or from the burned clothing or other adhered materials.

The cause of death from severe burns is intoxication by pathological cleavage-products of the body-proteids, which are caused to break up into abnormal and poisonous compounds. Their presence in the urine is of grave prognostic import, for one of the cases did not appear at first to be of great severity, although it terminated in death. Sigmund Fraenkel and Spiegler (Wiener med. Blätter, No. 5, '97).

Of the theories that have been held as to the cause of death in cases of burns, Sonnenburg's is the most probable: that of a reflex lowering of the vascular tone, with consequent cardiac paralysis; but parenchymatous changes and degenerations in the kidneys, lungs, brain, etc., are to be taken into account. Case in which numerous streptococci were found in the blood after death, this showing that burns should be treated with strict regard for antisepsis. Tschmarke (Cent. f. Chir., July 10, '97).

After examining the blood in ten cases the writer records the following points: The blood flows sluggishly, and is of a peculiar dark, purple appearance. An immediate increase in the number of erythrocytes, in severe, but not fatal, cases, of from 1,000,000 to 2,000,000 per cubic millimetre, takes place within a few hours; in fatal cases, of from 2,000,000 to 4,000,000 per cubic millimetre. A rapidly increasing leucocytosis constantly occurs,—in cases ending in recovery often of 30,000 or 40,000 per cubic millimetre; in fatal cases usually above 50,000 per cubic millimetre. Morphological changes in the erythrocytes are slight. The percentage of neutrophiles is somewhat above the normal, but not so much as in the ordinary inflammatory leucocytosis. A considerable destruction of the leucocytes takes place, especially in very severe burns. Myelocytes may be present in small numbers in severe cases. There is, as a rule, marked increase in the number of blood-plates. E. A. Locke (Boston Med. and Surg. Jour., Oct. 30, 1902).

Prognosis.—The termination of this class of injuries is often of serious import especially when medico-legal questions arise. This should be determined by the several factors which arise in each case. Consideration must be given to individuality of the sufferer, both his age and constitutional acquirements; the extent of the burn, both as to surface and depth involved; the location of the injury, and the nature of the exciting medium. The effects upon strong, robust subjects are not so marked as upon those of weaker constitutions, and, while the same degree or extent of burn will soon be recovered from by the former, the most dire results may follow in the latter persons. Thus it may be noticed that burns among machinists, glass-blowers, plumbers, and foundrymen will not be so serious as would the same degree or extent among clerks or those engaged in gentlemanly pursuits. Colored persons suffer less severely than do the white. Females, on account of more delicate systems, are less able to resist shock than are the males. Middle life is not so severely affected as are children or aged people. Some persons may be able to resist the shock only to be carried off by the complications that arise.

Surface involvement seems to exert a greater depression or fatality than does depth of tissue. A burn, even of the first degree, which occupies an extended area and those of the second may terminate fatally if one-fourth or one-third of the superficial parts are involved; a fatal issue may also occur in burns occupying one-half of the body-surface. A burn of the second degree which occupies only a limited extent of surface, but which destroys the epidermis entire, may end in recovery, while those of the third may, through their deep involvement, produce complications with which we are unable to combat. Burns occupying the abdomen give the highest mortality, while those of the thorax are only second to a slightly minor extent; but those of the head, neck, and limbs prove fatal in many instances.

> [Of 26 cases seen by Sajous after a boiler explosion, on the Lake of Geneva, in 1892, 22 died within a few hours after the accident, although, with few exceptions, the scalds, though involving the greater part of the body, did not reach beyond the epidermic layer, excepting over the face and hands. Ed.]
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> Of the 298 men killed or injured on the Japanese side of the Battle of the Yalu, a large number had received burns covering an area of more than one-third of the body. Only 2 out of the 57 cases of this class recovered. Susuki (Boston Med. and Surg. Jour., Dec. 9, '97).

The nature of the exciting medium often governs the termination of burns, and those produced by cohesive bodies cause the greater destruction of part or life. The length of time required for the partial or complete reparation of the surface may be an important question in medico-legal cases. This can only be governed by the type of injury, the length of contact of the exciting agent, the nature of the affected person, and the general aspects of the case in question.

Treatment.—Constitutional.—The constitutional treatment is to be directed toward the relief of pain, the restoration of the depressed vitality at the time of accident,—*i.e.*, sustaining the system throughout the entire restorative process. Pain is best relieved by opium, or its alkaloid, morphine (preferably by hypodermic injection), because these agents have little, if any, depressing action upon the cardiac functions. The dose required will be much greater than ordinarily used, because of the sudden character and great amount of depression in these injuries.

Vitality must be restored as quickly as possible, and the use of ammonia (preferably carbonate), strychnine, and caffeine (because of their stimulating effect upon the cardiac muscle); hot drinks, such as milk and tea; alcoholic drugs in the form of whisky or brandy, and the production of local or generalized sweating. A most desirable plan of restoring heat is by using hot-water bottles placed at regular points so as to diffuse its effects. Other means, as, for instance, covering the body with a sheet and conveying heat through a pipe or by placing heated bricks beneath this covering. To keep the sufferer fairly comfortable during the local treatment stimulation must be kept up, care being taken not to produce overactivity and thus allow reaction to prove as deleterious as the effect of the burn.

The functions of the body must be regulated, the bowels being kept free or confined, according to the conditions present; the action of the kidneys should be watched. In some cases it may be wise to anæsthetize the patient during the first few hours immediately following the burn, and especially during the first dressings of aggravated cases.

Local.—The local treatment is to be directed toward the limitation of the resulting inflammation, the prevention of septic infection, assisting the normal elimination of the eschar, the development of granulations, and limitation of the deformity.

In burns of the first degree little or no treatment may be demanded. In the more aggravated cases of this type the application of home measures, such as bicarbonate of sodium, the white of egg and sweet oil (equal parts), lead-water and laudanum, and the various hot or cold means generally at the disposal of housewives.

Burns of the second and third degrees must be more strenuously treated. It is often a difficult problem to know which is the more soothing application to be advised and from which we may get the better result. In one case hot applications, in another cold; in some wet, and in others dry, measures are to be given. The vesicles, if numerous, should be untouched; but if only a few, they are best evacuated.

Prof. S. D. Gross was wont, in many mild and severe cases, to use ordinary white-lead paint; the results achieved were often marvelous.

> [This is a remarkably efficacious measure. Mere painting of the burn, as if it were an article of furniture, etc., causes immediate cessation of the pain. Ed.]

The use of carbolized vaselin (15 to 30 grains to the ounce), watery solutions of carbolic acid (about 20 grains to the ounce), subnitrate of bismuth ($^1/_2$ to 1 drachm to ounce of ointment of zinc oxide or petrolatum), boric acid (either in watery saturated solutions or ointments of either zinc oxide or petrolatum in strengths varying from $^1/_2$ to 2 drachms to the ounce), bicarbonate of soda in almost full strength (in ointment or watery solutions), and starch in varying proportions will usually be found very efficacious.

Turpentine, where granulations are sluggish, will give excellent results used either in full or diluted strengths, giving care not to produce too much stimulation. H. L. McInnis states that spirit of turpentine applied to a burn of either the first, second, or third degree almost at once relieves the pain, while the burn heals. After wrapping a thin layer of absorbent cotton over the burn, the cotton is saturated with common turpentine and covered with bandages. Being volatile, the turpentine evaporates, and

it is therefore necessary to keep the cotton moistened with it. When there are large vesicles, these are opened on the second or third day. It is best to keep the spirit off the healthy skin if possible to avoid the local irritation.

Turpentine applied to a burn of either the first, second, or third degree will almost at once relieve the pain. The burn heals very rapidly. It is applied as follows: After wrapping a thin layer of absorbent cotton over the burn it is saturated with the turpentine and bandaged. The common commercial article found in every house is sufficient. H. L. McInnes (Brit. Med. Jour., Sept., '96).

Surgery of this day has placed many excellent antiseptics at our disposal, and there is no better application than bichloride of mercury in the proportion of 1 or more grains, preferably the former, to 1000 parts of water and kept in constant contact, the dressings being made without removing the former cloths.

Ichthyol in watery solutions (1 or more drachms to the ounce), or in glycerin similar strength), or even in ointment form (with zinc oxide or petrolatum, about 1 to 3 drachms to the ounce) and the iodine derivatives, such as iodol, aristol, europhen (given preferably in ointment, 15 to 30 grains to the ounce of petrolatum or lard) are reliable measures.

Ichthyol is efficacious in treatment of burns of the first and second degrees. It allays the pain at once and slight superficial burns heal rapidly. In burns of the second degree with the formation of bullæ, even when extensive areas are involved, the remedy also acts favorably. It is used dry, diluted with zinc oxide or bismuth, the powder being spread evenly over the surface; in ointment (10 to 30 per cent.); or as a combination of these two methods. The powder is the most satisfactory form in extensive burns of the first degree, and should be plentifully applied. In extensive burns of the second degree the soft paste is preferable.

The zinc-oxide powder may be combined as follows:—

℞ Zinc oxide, 20 parts.
Carb. magnes., 10 parts.
Ichthyol, 1 to 2 parts.

While the paste is mixed as follows:—

℞ Carbonate of lime, 10 parts.
Zinc oxide, 5 parts.
Oil, 10 parts.
Lime-water, 10 parts.
Ichthyol, 1 to 3 parts.

Leistikow (Monat. f. prak. Derm., Nov. 1, '95).

Ichthyol used in cases of severe burns with remarkable success. It is applied pure and in a rather thick layer, talcum powder being then liberally sprinkled on it, and plenty of cotton batting applied, the whole being fixed in place by means of a strip of soft material. The bandage should not be renewed. After three or five days it is removed. If the contents of large vesicles are gelatinous, or if the vesicles are already cracked, it is necessary to remove the detritus before applying the ichthyol.

Disinfection is entirely unnecessary. Should the bandage have become wet through from excessive secretion on the second day, it should be removed, and a new application of ichthyol with fresh cotton be made. Fr. E. Mueller (Aerztl. Rundsch., No. 21, '99).

Thiol has been found useful for all degrees of burn. According to Bidder, it allays pain very rapidly and arrests cutaneous hyperæmia. In this manner it tends to prevent ulceration and scarring.

Thiol especially valuable in burns of the second degree. Suppuration and cicatrices are avoided even after burns of the third and fourth degrees. The parts are first washed with a weak antiseptic solution, and the cuticle that may be hanging loose from ruptured blisters is removed, taking care to leave intact those that have not opened. After dusting the burn with boric acid the entire surface of the burned region and

the skin around it are painted with a solution of equal parts of thiol and pure water. A layer of greased cotton is then laid on the burn, and kept in place with a loose bandage. Giraudon (Thèse de Paris, '95).

Aristol—which occurs in crystals of a light-reddish-brown color, soluble in water, slightly soluble in alcohol, and freely soluble in ether and fats—is another valuable agent in burns of the second and third degrees, and has been found strikingly effective where other remedies have failed.

Pain is almost instantly relieved and healing is rapid. Haas (Deutsche med. Woch., p. 783, '94).

It may be used in the form of powder or mixed with oil or vaselin. The surface should be disinfected with a boric-acid lotion, and after opening the vesicles aristol is applied and the whole is covered with sterilized cotton-wool, gutta-percha paper, and a bandage. The application of aristol powder directly to the wound at the beginning hinders the dressing from soaking up the secretion; when the latter has diminished, however, aristol may be applied either alone or in a 10-per-cent. ointment with olive-oil, vaselin, and lanolin.

Aristol is of great service in the treatment of scalds and burns. After a thorough disinfection and cleansing of the burned area, and the opening of the vesicles, a dressing is applied of aristol salve, smeared upon sterilized gauze in a layer of about the thickness of a knife-blade, and this dressing is changed daily. The dressing is covered with cotton, and held in place with gauze bandages. In personal cases, at first an aristol salve, consisting of 5 grammes; ol. olivæ, 10 grammes; lanolin, 40 grammes, was applied, and, when the wound surface had become smaller and granulations had formed, aristol powder was dusted on, and covered with gauze and cotton. Edward Roelig (Deutsche med.-Zeit., No. 56, '99).

Of late the French surgeons have lauded picric acid used in saturated solutions with water (increasing the solubility by means of the addition of 1 ounce of alcohol, as the acid is soluble to the extent of only 2 drachms to the quart of water). They claim that it is particularly useful for the relief of pain and that it greatly assists the formation of granulations. I can subscribe to both of these statements, as many excellent results have followed its use in my hands.

A remedy for burns must be analgesic, antiseptic, and also keratogenous: three qualities possessed by picric acid in solution of 1 to 200. Its use is also free from accidents sometimes caused by antiseptics. Filleul (L'Union Pharm., Dec., '95).

Picric acid employed extensively, using a solution made by dissolving 1½ drachms of picric acid in 3 ounces of alcohol, which is then diluted with 2 pints of distilled water, a saturated solution being thus procured.

The clothing over the injured part should be gently removed, and the burnt or scalded portion should be cleaned as thoroughly as possible with a piece of absorbent cotton-wool soaked in the lotion. Blisters should be pricked, and the serum should be allowed to escape, care being taken not to destroy the epithelial surfaces. Strips of sterilized gauze are then soaked in the solution of picric acid, and are so applied as to cover the whole of the injured surface. A thin layer of absorbent cotton-wool is put over the gauze, and the dressing is kept in place by a light linen bandage. The moist dressing soon dries, and it may be left in place for three or four days. It must then be changed, the gauze being thoroughly moistened with the picric-acid solution, for it adheres very closely to the skin. The second dressing is applied in exactly the same manner as the first, and it may be left on for a week.

The great advantages of this method of treatment are: First, that the picric acid seems to deaden the sense of pain;

and, secondly, that it limits the tendency to suppuration, for it coagulates the albuminous exudations, and healing takes place under a scab consisting of epithelial cells hardened by picric acid. A smooth and supple cicatrix remains, which is as much superior to the ordinary scar from a burn as our present surgical scar is superior to that obtained by our predecessors, who allowed their wounds to granulate. D'Arcy Power (Medico-Surg. Bull., Feb. 10, '97).

Personal experience in fifty cases has shown that it is advisable to let the shreds of clothing which have been burned into the skin remain until the second dressing; the cloth having been asepticized by burning, it will do no harm by remaining, while removal can only be accomplished by stripping away the flesh. The cloth will act as a capillary drain into the skin and it will promote a permeation of the acid solution into the injured tissue. At a second dressing the thoroughly-soaked fibres can be more easily removed. Dressings soaked in picric-acid solution do not adhere as much as other applications. Thompson (St. Louis Med. Review, Feb. 20, '97).

The best topical application to hasten cicatrization in burns is picric acid. Its application is recommended from superficial burns to those of the third degree. It is contra-indicated in deep, old, or suppurating burns, and in very young children. Technique consists of antiseptic cleansing of the burn in a picric-acid bath of 1 per cent., with a careful preservation of the epidermis. This washing is to be repeated, taking all possible care to prevent raising the epidermis. When burns are very superficial, remarkable cures have been effected by painting with ether or alcohol saturated with picric acid. Dakhyle (Le Progrès Méd., Jan. 7, '99).

The combination of picric and citric acids, which Esbach devised for the detection of albumin, is more effective than the picric acid alone, in burns of the second degree.

Esbach's solution consists of 10 parts of picric acid, 20 of citric acid, and 1000 of water. Without any elaborate attempts at antisepsis the bullæ and vesicles should be opened with a clean blade and the fluid applied freely, care being taken that the solution reaches the interior of each one. The combination after the first smart has passed removes the pain very quickly. After the excess of fluid has drained off the part may be covered with tissue or soft gauze and left undisturbed for several days. After two or three days the fluid should be reapplied to such areas as are moist and the part carefully recovered. E. M. Alger (Ther. Gaz., June 15, '99).

For burns in infancy and children the best application is a 1-per-cent. aqueous solution of picric acid. This gives almost immediate relief from pain, and healing takes place rapidly. After the burned area has been coated once or twice with the solution a thin layer of absorbent cotton may be applied dry, and over this a layer of impervious tissue, and, finally, as much cotton as may be required for warmth, protection, exclusion of air and germs, and over this a loose bandage. Charles Warren Allen (Pediatrics, Mar. 15, 1901).

One can claim that picric acid has unusual properties among external medicaments. While it possesses marked antiseptic qualities by reason of the drying and hardening of the tissues that it produces, it has at the same time no injurious or irritant action on delicate, young, growing epithelium. Its anæsthetic effects still further enhance its value. Milward (Lancet, Sept. 12, 1903).

Some French observers also claim that it is not poisonous, and that, excepting its effect upon the urine, which it turns very yellow, it has no other bad effects; but negative evidence has been adduced, however, and several cases of poisoning (smarting at the part of application, with the production of vomiting in the course of twenty-four hours) have been recorded by Walther, Berger, Labouche, Tuffier, and others. Colic, diarrhœa, yellowish discoloration of the skin, sleep-

iness, and scanty, dark-colored urine were the main symptoms.

Calcined magnesia is a valuable agent for the treatment of burns of the first and second degrees.

> The affected parts are covered with a thick layer of a paste, which is prepared by mixing the calcined magnesia with a certain quantity of water. This paste is allowed to dry on the skin, and when it becomes detached and falls off it is replaced by a fresh application. Very soon after the paste is applied the pain ceases, and under the protective covering formed by the magnesia the wounds recover without leaving the cutaneous pigmentation which is so often observed to follow burns that have been allowed to remain exposed to the air. Vergely (Revue Méd., Feb. 16, '96).

Iodoform is anæsthetic and antiseptic. It may be left *in situ* for a considerable period—a week—without necessitating a change of dressing. It should not be strewn upon the raw corium nor upon granulating tissues.

> After accidents by burning, and particularly where the surface of the skin destroyed has been very extensive, atrophy of the optic nerves has resulted. It is also known that iodoform is capable of giving rise to a form of toxic amblyopia, resembling somewhat closely that produced by alcohol or tobacco. Whether these eye-symptoms are due to the burn in all cases, or to absorption of iodoform (and similar substances) applied to the wound, the possibility of the occurrence of a condition so very serious ought to be borne in mind. Terson (Arch. d'Opht., Oct., '97).

Nitrate of potassium, or nitre, has been found to be useful in all kinds of burns, and may be employed to great advantage when the other agents described cannot be had. It acts mainly as a refrigerant by causing notable lowering of the temperature of the liquid used as solvent.

> If a burned hand or foot is plunged into a basin of water to which a few spoonfuls of the nitrate have been added, the pain ceases rapidly; if the water becomes slightly heated, the pain returns, but it is allayed as soon as a fresh quantity of the salt is added. This bath, which is prolonged from two to three hours, may bring about the definitive disappearance of the pain and even prevent the production of blisters. The application of the compresses also exercises the same influence. By this means the pain is allayed and cicatrization takes place without delay. Poggi (Revue Méd., Feb. 16, '96).

Any complication, such as bleeding, of small or large vessels, must be checked by appropriate surgical measures. Sepsis must be prevented by the early removal of any obnoxious material. Particles of dead skin laying over the surface are to be removed, clothing if present, if that can be accomplished without any further destruction of the tissues, thereby exposing the healthy parts, or producing pain to the sufferer.

> Emphasis upon the great importance of keeping the injured part aseptic; the patient may recover from the shock only to die of blood-poisoning. This is especially to be feared where the side of the face and the chest are extensively burnt. The wound should be at once thoroughly disinfected. It is then covered with subnitrate of bismuth, and then with iodoform gauze, kept in place by light bandages. Tschmarke (Deutsche Zeit. f. Chir., vol. xliv, pp. 346-392, '97).

> The fatal result in severe burns is due to the absorption of a toxic substance derived from chemical changes in the burnt tissues. The lethal tendency is best met by removing the necrosed tissues and infusing saline solution. Three cases of very severe burns in which the patients were in a most critical condition, with stupor, suppression of urine, etc., in which recovery followed as a result of this method. The infusion was repeated daily for several days. Parascandolo (Centralb. f. Chir., Apr. 27, 1901).

Calcium hypochloride an excellent antiseptic. It is not largely used for burns, and therefore attention is called to the good results which have been obtained by the author. Having been dissatisfied with the usual methods of treating burns, putting up one foot of a smith, who had been burned on both feet, with calcium hypochloride, and the other one with oil was tried; the foot treated with the calcium healed in a fortnight, while the other took four weeks. A cool bandage with oil is now applied on the first day, which causes the vesicles to form quickly, and after twenty-four hours these are opened, under antiseptic precautions. Compresses steeped in the solution are then applied, and this is renewed after twenty-four hours, but they are kept moist by pouring on fresh solution during that time. It is of importance to leave the compresses on as long as possible, and to keep them constantly damp. Great care must be exercised in removing the old compresses not to disturb the scabs under which the wound is to heal. The solution which the author uses is:—

℞ Calc. hypochlor., 2.4 to 5 grammes (37 grains) (circa).
Aquæ destil., 9.900 grammes (35 ounces).
Solve, filtra, et adde:—
Spt. camphor., 5 grammes (85 minims).

F. Tichy (Deutsche med. Woch., July 17, 1902).

Granulations may often be assisted by powders of acetanilid in full strength, dusted over the surface, or by the use of some of the iodine derivatives, such as iodol, europhen, or aristol (15 to 60 grains to the ounce of powdered starch or ointment), applied to the exposed surface.

Limitation of deformity is a very serious problem. Splints are to be placed so as to prevent the parts from losing their anatomical relation and should be kept applied for some time after the parts have healed because of the inherent tendency of the contraction for long periods, even years, after the apparent cure. Bandages are to be kept continuously applied to prevent contiguous surfaces from becoming agglutinated. Massage must be advised at the very earliest moment so as to restore the pliability of the part and prevent ankylosis, when a joint is involved. Even with all the measures that we can adopt the loss of skin-tissue may be so extensive that skin-grafting will be the only means with which we can hope to restore the integrity of the part. The relief of cicatrices or contractions, ankylosis, or pressure upon the nerve-filaments sometimes requires the most energetic surgical interference.

Electrical Burns.—Electrical burns, according to Elder (Montreal Med. Jour., Jan., 1900), from contact with a "live wire" differ greatly in their behavior from ordinary burns. At first the clinical picture is very much that of moist gangrene or that of severe frost-bites. The pain is often very severe. The shock present is due both to the electrical contact and to the burn *per se*. They require one and a half to three times as long for recovery as ordinary burns. The sloughing affects principally the muscles and blood-vessels, and the blood does not appear to show any tendency to clot in these burns.

Case of severe burns caused by an electric current of 2000 volts. The patient, an electrician, 23 years old, came in contact with a live wire and received severe burns of the head, chin, right shoulder, and wrists. The burn on the head was followed by necrosis of the bone and suppuration of some of the gray matter, for which the patient was trephined. After a protracted illness the man made a good recovery. Lapsakoff (Bolnitchnaja Gazeta Botkina, Oct. 16, 1902).

Treating Electrical Burns.—The treat-

ment found most efficacious by Elder (Montreal Med. Jour., Jan., 1900) is to keep the limb in a warm carbolic-lotion bath of 1 in 100 strength, taking precautions against the possibility of the occurrence of secondary hæmorrhage. If secondary hæmorrhage occur, or when a definite line of demarkation has formed, the necrosed tissue must be removed. In many cases amputation is necessary, but the skin-flaps should not be closed, because large masses of muscles are sure to slough away subsequently. The wound should be allowed to granulate, and subsequently be skin-grafted. Immediately after the burn hypodermic injections of morphine ($^1/_6$ grain) and strychnine ($^1/_{30}$ grain) may be given alternately. To lessen the offensive odor the 1 in 100 carbolic lotion may be replaced by a bath of 1 in 10,000 perchloride of mercury. In addition, morphine, phenacetin, caffeine, chloral-hydrate, and potassium bromide may be administered together.

Treatment of electrical burns consists in immobilization of the part and protection with sterile gauze, and, if the burn is extensive, skin-grafting. Mally (Revue de Chir., Mar. 10, 1900).

J. Abbott Cantrell,
Philadelphia.

BUTYL-CHLORAL. See Chloral.

C

CADE. See Juniper.

CAFFEINE. See Coffee.

CAJUPUT-OIL. — This is a bright-green, mobile, volatile oil had by distillation from the leaves of the *Melaleuca leucadendron* (*M. cajuputi*): a tree indigenous to the Orient. It has a strong camphoraceous odor and aromatic, bitter taste. A rectified oil is also obtainable, which may be colorless or of light-bluish-green hue, but with age is apt to turn yellow. With an equal volume of alcohol cajuput-oil affords a clear solution which either has a slightly-acid reaction or is neutral. The chief constituent is held to be *cajuputol*, which is claimed to be identical with eucalyptol, though this requires verification, therapeutically at least.

Preparations and Doses.—Cajuput-oil, 1 to 10 minims.

Essence of cajuput (oil of cajuput, 1; rectified spirit, 9), 10 to 60 minims.

Cajuput mixture (Hunn's life-drops: oils of cajuput, anise, cloves, and peppermint, of each, 1 part; rectified spirit, 4 parts), 30 to 60 minims.

Physiological Action.—Taken internally, oil of cajuput causes a sensation of warmth in the stomach, excites the action of the heart and arterial system, and subsequently induces copious diaphoresis. Externally, either alone or combined with equal parts of soap-liniment or olive-oil, it is rubefacient.

Therapeutics. — This is a remedy of much power and value, one too much neglected in general practice. Unfortunately its therapeutic value is not understood, and its chemical relation, real or supposed, has done the drug great injustice. It is powerfully stimulant, carminative, stomachic, antispasmodic, anthelmintic, and antiparasitic; also has a slight narcotic and anodyne action.

Gout and Rheumatism.—When applied topically, and also given internally, in these affections, this remedy is often of the greatest service; it should be given by the mouth in 4- to 6-drop doses, as often as every second hour, and some-

times every hour in retrocedent gout, in which it is especially serviceable.

Intestinal Fluxes.—In cholera infantum, cholera nostras, Asiatic cholera, and the lesser intestinal fluxes, it has been greatly lauded, and, while it often appears of incalculable value, it is known to be a somewhat uncertain remedy.

Nervous Diseases.—In hysteria it is sometimes beneficial, particularly hysterical dysmenorrhœa; also in those neuralgias that are of purely nervous type,—*i.e.*, not dependent upon a localized inflammation.

Febrile Maladies.—In low fevers it is, perhaps, the best diffusible stimulant known, and it deserves far greater attention as regards this class of maladies than has been hitherto accorded to it.

External Use.—Externally applied, cajuput-oil is of value in the treatment of a number of skin maladies. It is also useful, oftentimes, in sprains and contusions, etc.

CALABAR-BEAN. See Physostigma.

CALCIUM.—This metal is not found in nature in its pure state, but appears in the mineral kingdom as marble, limestone, calcspar, gypsum, selenite, alabaster, fluorspar, apatite, phosphorite, etc.; in the animal kingdom as a phosphate and carbonate. It is present in all vegetables. Calcium is a light, yellow, very hard, malleable, and ductile substance that melts at red heat, tarnishes in air, and decomposes water. It is rapidly acted on by dilute acids, and when heated burns with a brilliant, white light. In medicine it appears only in the form of salts, and the physiological action is modified by the individual acid constituent.

Preparations and Doses. — Calcium bromide, 10 to 60 grains. See Bromine.

Calcium benzoate, 5 to 10 grains. See Benzoic Acid.

Calcium carbonate (precipitated), 5 to 40 grains.

Calcium chloride, 5 to 15 grains.

Calcium hippurate, 1 to 5 grains.

Calcium hypophosphite, 3 to 6 grains.

Calcium iodide, 1 to 4 grains. See Iodine.

Calcium lactate, 1 to 5 grains.

Calcium phosphate (precipitated), 10 to 30 grains. See Phosphorus.

Calcium sulphate (gypsum). Used in the preparation of plaster of Paris.

Calcium sulphide, $^1/_{10}$ to 3 grains.

Calcium sulphocarbolate, 2 to 5 grains.

Calcium salicylate, 2 to 8 grains. See Salicylic Acid.

Calcium hypophosphite, syrup, 1 to 4 drachms.

Calcium iodide, syrup, 15 to 30 minims.

Calcium lactophosphate, syrup, 2 to 4 drachms.

Lime-water, 1 to 4 ounces.

Lime-water, chlorinated, 30 to 60 minims.

Physiological Action.—Lime neutralizes any excess of acid in the stomach and intestines. It is but slowly absorbed and passes into the blood only in small quantities, although sufficient is taken up to promote nutritional changes. It also exerts a digitalic action on the heart: when the proportion of lime present is deficient, the contractions are weak; but when the quantity is increased they become powerful. It is eliminated by the intestines, and to some extent by the kidneys, inasmuch as the urine becomes alkaline under its administration.

Pure precipitated carbonate of calcium appears to be medicinally of less value than the impure form, which obtains the names of "precipitated" and "prepared chalk"; both are neutral

salts and antacids, but the latter is more astringent.

Calcium chloride is stimulant, astringent, alterative, resolvent, and antiseptic. Calcium sulphide acts very much like the chloride, but is more powerful. The effects of both depend upon their power to readily and quickly part with their gaseous constituents, viz.: chlorine and sulphuretted hydrogen, respectively. The former is more powerfully irritant and cathartic.

Lime-water is chiefly antacid, but at times appears to act as a sedative to the gastric viscus. It, as well as certain of the lime salts, not infrequently gives rise to disturbance of digestion and loss of appetite; vomiting has been observed to follow its employment. There may be an increase in the amount of urinary secretion, but the stools are usually retarded, though sometimes diarrhœa is a result.

Calcium peroxide forms a yellow alkaline powder slightly soluble in water. It possesses a decidedly good action in acid dyspepsia and summer diarrhœa occurring in children. It acts as a powerful antiseptic because of the nascent oxygen liberated in the intestines. Daily dose ranges from 3 to 10 grains, according to the age of the child; best given in milk. It is advisable to dispense the preparation in parchment papers preserved in well-closed glass-stoppered bottles, to prevent decomposition. I. Reszkowski (Merck's Bericht, 1900).

Therapeutics. — Diarrhœas. — Precipitated chalk is chiefly employed for its neutralizing effect upon the acid secretions of the *prima viæ*; hence finds place among the remedies recommended for the diarrhœas of infancy and childhood; it is also astringent, and usually prescribed in conjunction with opium. It is not, however, the valuable remedy claimed by earlier writers, and its place, to considerable degree, has been most advantageously usurped by bismuth subcarbonate and cerium oxalate; further, the more modern treatment of intestinal fluxes is directed toward removal of the cause, rather than, as formerly, combating a mere symptom.

Calcium chloride—not calx chlorata—has on several occasions been relegated to the list of obsolete remedies, but as often has been again brought forward. There is very little difference in therapeutic applicability from that of calcic sulphide, except in degree of activity and size of dose; therefore the remarks regarding one may be safely considered as equally true of the other.

As Alteratives and Resolvents.— Both are applicable to a number of maladies, chiefly those of a strumous, septic, or pseudoseptic character; they have likewise been employed to some extent in the different forms of tuberculosis. It is freely soluble in water.

Skin Disorders. — Chloride of calcium will often abort furuncles and produce a salutary influence upon all strumous cutaneous affections: acne, lupus, etc. It has recently been recommended as a depilatory.

In many instances it will abort furuncles, but the most marked effect of calcium chloride is in acne. All strumous cutaneous affections, especially lupus, are often benefited by it. The caries and necrosis of the same diathesis, rickets, indurated glands, and tabes mesenterica are also conditions in which it may be employed with some expectation of benefit. Ovarian and uterine tumors are reported to have decreased in size under long-continued use of the drug. It is also a powerful irritant and cathartic.

In all itching skin diseases calcium chloride may be given after meals. There are no absolute failures, but it remains to be determined in what class

of cases it is most useful. Saville (Brit. Med. Jour., vol. i, '97).

Calcium sulphide recommended as a depilatory. It is perfectly harmless to the skin and does not irritate abraded surfaces. It can be made by heating a granulated mixture of plaster of Paris (calcium sulphate) with granulated wood-charcoal (to take off the oxygen). A high temperature is necessary, and it is best obtained by means of gas. A muffler is used—*i.e.*, set in cinders or bone-ash—and the mixture is heated to redness. The dry, rose-colored or whitish product is applied to the skin in a wet condition, or it may be put on dry and then wetted. A. W. Brayton (Jour. Amer. Med. Assoc., Apr. 16, '98).

PNEUMONIA.—In the past the remedy has been much lauded in pneumonia, and lately it has again been recommended in this malady.

In lobar pneumonia calcium chloride reduces temperature and keeps it within safe or normal limits in spite of the continuance of physical signs. Moreover, there is a tendency for the morbid process to be arrested at whatever stage the drug is given in efficient doses, whereby the course of the disease is shortened or rendered milder. Also there is singular freedom from all anxiety, distress, and danger: a freedom not usually associated with continuous high temperature. Crombie (Practitioner, London, '96; Med. Age, Mar. 10, '96).

HÆMORRHAGE. — On the plea that chloride of calcium was capable of increasing the coagulability of the blood Wright, Freudenthal, Perry, and others have tried this preparation in the bleeding of hæmophilia. It is to be given in 2-grain doses every four hours.

Acting on Freund's theory that coagulation of the blood is directly proportionate to the excess of calcium phosphates, these salts were employed in serious hæmorrhages; 15 1/2 grains were given every 2 hours in water until 2 or 2 1/2 drachms of the hypophosphite of calcium was administered. Metrorrhagias, intestinal hæmorrhages (typhoid), gastrorrhagia, and epistaxis were very rapidly checked. For checking most hæmorrhages this may be relied upon. M. Silvestri (Bull. Méd., Feb. 6, '98).

INFLUENZA.—In doses of 1 grain daily calcium sulphide has, on various occasions, shown a very favorable action over influenza, and not infrequently the attack is aborted.

Calcium eosolate is valuable in the treatment of diabetes insipidus, diabetes mellitus, and chronic ulcerative phthisis. Dose is from 4 to 10 grains three or four times a day. It is soluble in from 8 to 10 parts of cold and in 7 parts of hot water. H. Stern (Jour. Amer. Med. Assoc., xxxiv, p. 467, 1900).

CALCULI, BILIARY. See CHOLELITHIASIS.

CALCULI, SALIVARY. See SALIVARY GLANDS.

CALCULI, VESICAL. See URINARY SYSTEM, SURGICAL DISEASES OF.

CALOMEL. See MERCURY.

CAMP FEVER. See TYPHUS FEVER.

CAMPHOR.—This is a peculiar, concrete, volatile substance obtained by sublimation from the *Cinnamomum camphora*: a native of China, Japan, and some of the isles of the East Indian Archipelago. Camphor is also found in white crystals in the fragments in the wood of *Dryopalanops camphora*. It appears in small quantities in various other plants, and Tenasserim camphor, which is of fair quality, is a yield of the leaves and stalks of *Blumea grandis* (or *campher*). It is sparingly soluble in water, but freely so in alcohol, ether, chloroform, and fluid and volatile oils; with chloral or carbolic acid it forms a clear liquid. As found in the shops, it is a white, translucent gum of tough,

almost crystalline structure, possessed of a pungent, bitter taste that leaves in the mouth a feeling of coolness. Camphor is incompatible with acids, iodine, etc.

Camphoric acid is formed by oxidation of camphor with nitric acid, and appears as a white, microcrystalline powder, very slightly soluble in water, with a faint aromatic odor and slight, saline, camphor taste.

Camphor-chloral is merely a mixture of equal parts of gum-camphor and chloral-hydrate whereby is produced a colorless, syrupy liquid, which is soluble in alcohol, ether, chloroform, benzin, glycerin, fixed oils, and aqueous solutions of chloral; but when added to water it is decomposed, the chloral passing into solution, while the camphor is precipitated.

Camphor-menthol is made by rubbing together equal parts of menthol and camphor whereby a clear liquid is formed. Camphor-thymol is made in the same way, precisely, as camphor-menthol. Other compounds are formed in like manner of the two foregoing by combining camphor and salol and camphor and resorcin. Camphor-oil is a crude residual product resulting from the distillation of camphor-gum.

Camphor-monobromate, or monobromated camphor, is had by heating camphor-gum and bromine, previously dissolved together in benzin, and then crystallizing from hot alcohol; it is almost insoluble in water, but readily dissolves in alcohol, chloroform, ether, and fixed oils.

Camphor-salicylate may be prepared by heating together carefully 84 parts of camphor and 65 parts of salicylic acid, until a liquid, homogeneous solution is formed, which becomes a crystalline mass on cooling; this again becomes unctuous when compressed, and liquefies when rubbed on the skin. It may be obtained in definite crystals from a benzin solution. It is slightly soluble in water and glycerin, about 1 to 20 in fats or oils, and is decomposed by hot alkaline solutions. By boiling with water it hydrates into an oily liquid.

Carbolized camphor, or phenol-camphor, is had by adding 2 parts of camphor-gum to 1 part of carbolic acid, and is a colorless, oily liquid, soluble in fixed oils, alcohol, and ether, but nearly insoluble in water and glycerin.

Preparations and Doses. — Camphor-chloral, 2 to 20 minims.

Camphor, carbolized, external use only. See PHENIC ACID.

Camphor-gum, 2 to 20 grains.

Camphor-liniment (camphor, 1; olive-, peanut-, or cotton-seed oil, 4).

Camphor liniment, compound (camphor, 20 drachms; lavender-oil, 1 drachm; strong ammonia-water, 5 ounces; rectified spirit, 15 ounces).

Camphor-menthol, 1 to 5 grains.

Camphor, monobromated (bromide of camphor), 1 to 12 grains.

Camphor-oil (crude), external use only.

Camphor, salicylated (salicylate of camphor), 1 to 5 grains.

Camphor spirit (tincture of camphor), 5 to 30 minims.

Camphor-thymol, 1 to 5 grains.

Camphorated oil (camphor, 1; sweet almond oil, 9), 5 to 60 minims.

Camphorated tincture of opium (paregoric), 30 minims to 4 drachms. See OPIUM.

Camphoric acid, 5 to 30 grains.

Physiological Action. — Externally camphor is somewhat rubefacient, readily irritating the skin. Given internally, it acts chiefly upon the brain, cord, and circulatory apparatus. In small doses it increases the action of the

heart and arteries: the pulse is rendered softer and fuller. It exhilarates the spirits, and excites warmth of body, promoting diaphoresis; but these effects are transitory and fleeting and apt to be followed by depression. In larger doses it is sedative, antispasmodic, somewhat hypnotic and analgesic, and sometimes markedly anaphrodisiac. In poisonous doses it irritates the gastro-intestinal mucous membrane; induces nausea, vomiting, vertigo, delirium, maniacal excitement, and convulsions of an epileptiform character; cardiac prostration and muscular weakness are often very pronounced. It is antidoted by emetics, rapid-acting cathartics, and stimulants.

> Case of a lady, 78 years of age, who took an unknown quantity of spirit of camphor. About an hour after taking it she became comatose, and finally appeared to be dead. Consciousness returned after a considerable interval, and it was found on examination that her right hand and right side of her face were paralyzed. In four weeks she was able to walk about the room with assistance. Some five months later she could pick up a pin from the floor with the afflicted hand, and there was no perceptible trace of the facial paralysis. Treatment consisted of tonic doses of nux vomica and gentle massage to the affected parts. T. B. Greenley (Amer. Pract. and News, July 15, 1900).

Camphor-chloral combines the virtues of the two drugs from which it is derived; it is sedative, hypnotic, and narcotic.

Monobromated camphor is moderately stimulating and diaphoretic, but is scarcely a *succedaneum* for other bromides; it decidedly lowers temperature; is anodyne, antispasmodic, and narcotic; in large doses, sedative. In very large doses it depresses and weakens the heart's action.

Salicylated camphor acts very much like monobromated camphor; it is less antiseptic, however, and more analgesic. Very large doses of either this or the monobromated form induce muscular trembling and clonic convulsions.

Camphoric acid is antiseptic, somewhat diuretic and astringent, and antisudorific. It is eliminated chiefly by the urine, which it renders clear and acid.

The physiological action of the other preparations is not sufficiently differential to require mention.

> The chief action of camphor upon the blood-vessels consists in a dilatation of the same, particularly in the areas of the vessels drained by the jugular and femoral veins. The direct exhibition of camphor in the blood-current produces a slight and transient stimulation of the vasomotor centres, expressing itself occasionally in a slight rise in blood-pressure, followed by a rapid fall. Sometimes there are noticed, after the administration of camphor, certain undulatory variations in the blood-pressure, occurring at irregular intervals. These are to be attributed probably to a reflex excitation of the vasomotor centres, following the increased irritability of the latter produced by camphor. H. Winterberg (Pflüger's Archiv, vol. xciv, Nos. 9 and 10, 1902).

Therapeutics.—As an Antigalactagogue.—The external uses of camphor are many and varied, and exemplified in almost every household. The tincture applied to the breasts of the nursing woman proves markedly antigalactagogic: an effect which is heightened and materially aided if the same is also administered at the time by the mouth.

Febrile and Infectious Diseases.—In low forms of pyrexia camphor is often a remedy of great value. A solution in acetic acid was at one time held to be an almost specific in common continued, pestilential, exanthematic, and puerperal fevers; and even yet it is admitted to be of great value, but difficult

to administer. It is, however, contra-indicated where there is either a flesh-red tongue or tenderness of the abdomen with diarrhœa. Latterly, more especially in Europe, the hypodermic administration of camphor dissolved in sweet almond oil is lauded in these maladies; also in asthenic and advanced stages of acute inflammations when the vital powers are greatly exhausted, and in delirium accompanied by depressed nerve-energy; but it sometimes requires to be reinforced, so to speak, by other stimulants and sedatives. In the main, however, the administration hypodermically has little to commend it over ingestion by the stomach.

In infectious diseases, the exanthemata, pleuro-pneumonia with meningeal symptoms, in infectious endocarditis, etc., more especially if the patient is in a condition of collapse, 15 to 45 minims of a 10-per-cent. solution of camphorated oil afford prompt relief, employed subcutaneously. Even so much as 15 grains of camphor daily, far from aggravating, ameliorated cerebral symptoms. From 7 to 15 grains produce remarkable restorative effects. Schilling (La Méd. Moderne, Nov. 30, '95).

In influenza, pneumonia, typhoid, broncho-pneumonia, etc., camphorated oil yields good results, but should be administered before the patient is too weak; it produces an increase of arterial pressure, free expectoration, and a feeling of physical well-being. If given by the mouth its taste may be disguised by essence of pepermint. It appears to be contra-indicated where there is great cerebral excitement. Tuassia (Gaz. deg. Ospitali, Mar. 8, '92; Brit. Med. Jour., Mar. 26, '92).

Camphoric acid in $^1/_2$-drachm doses one hour before bed-time, with a glass of milk or water, is of value for night-sweats. The medicine is best given dry on the tongue, and then washed down with water or milk. Coston (Ther. Gaz., Mar. 15, '99).

In small-pox and other exanthemata, when the eruption has receded, camphor in small and oft-repeated doses frequently causes restoration; but if there is inflammation of important viscera the drug is contra-indicated.

Mental and Nervous Diseases.—In the past, camphor obtained a foremost place in the treatment of insanity, and there is every reason to believe it is now too much neglected. When the patient is of nervous temperament, or there is deficient nerve or vital power; when the head is cool and the mental affection independent of vascular fullness or action; when there is much restlessness, low, weak pulse, or cold, clammy skin; or when exhaustion follows the foregoing or is superimposed on previous excitement, the drug may usually be given to marked advantage; but it is not to be advised when there is cerebral excitement with a hot skin, full pulse, and wild countenance. In puerperal insanity, especially, it is frequently of the most service; but here, as in all other conditions of mental alienation, it requires to be employed with discrimination.

Diseases of the Heart.—In heart-maladies camphor is occasionally very beneficial; it will frequently quiet tumultuous palpitations and remove the dyspnœa which often attends hypertrophy with dilatation.

Intestinal Fluxes.—Camphor, either in powder or tincture, is an excellent and popular remedy for the diarrhœas of summer and autumn, which so often assume a choleraic form. When the body is cold as ice, there is great prostration, the voice squeaky and husky, and the upper lip retruded, the effect of the remedy is said to be often marvelous.

It is essential to use the strong solution or essence (spirit) of camphor, of

which 3 minims should be given on a cube of sugar or on a crumb of bread every five minutes. After one or two doses the diarrhœa ceases, the pulse becomes stronger, color returns to the face, and the patient is on the high road to recovery. The tincture is almost equally useful in the initial rigor of acute specific diseases and in severe chill. Murrell ("Manual of Mat. Med. and Ther.," '96).

Few, if any, remedies are comparable to camphor in summer diarrhœa and cholera. Its benign influence in the latter disease is most conspicuous, for it generally checks the vomiting and diarrhœa immediately, prevents cramp, and restores warmth to the extremities. It must be given at the very commencement, and repeated frequently, otherwise it is useless. Four to 6 drops of the strongest tincture should be given every ten minutes until the symptoms abate, and then hourly. Ringer and Sainsbury ("Hand-book of Ther.," '97).

Therapeutics of Various Preparations of Camphor.—Monobromated and salicylated camphor have been employed in diarrhœa, dysentery, epilepsy, chorea, hysteria, asthma, neuralgia, etc. Not one is as marked in stimulant action as the camphor-gum or tincture, but the monobromate is an hypnotic of considerable power and an invaluable antispasmodic.

Salicylated camphor is said to be of marked utility when applied in the form of ointment to lupus and rodent ulcer. It is also employed in diarrhœa, but is in no way superior to the monobromate.

Camphor-chloral has found its chief employment in mania, delirium tremens, etc. It is said that the sedative effect is far in excess of that of either of its constituents. Prolonged narcotism, lasting several days, had followed excessive use of the drug. Applied topically it is often effective in relieving neuralgic pains.

Phenicated camphor was originally introduced as an anæsthetic and as an antiseptic dressing, but seems to have found favor with some in the management of skin maladies.

It is a useful application in toothache due to an exposed and inflamed pulp. A valuable deodorant to correct the fœtor arising from syphilitic ulcerations, malignant growths, gangrene of the lungs, bronchorrhœa, and pneumothorax. It reduces the discharge and relieves the pain in acute otitis media; a 10-per-cent. solution in glycerin should be used. Also available in otorrhœa and in acute perforation of the tympanic membrane in 1- or 2-per-cent. solution. Is an efficient antiseptic in foul and indolent ulcers, and may be used in the form of a lotion: 8 to 15 grains to the ounce. Butler ("Text-book of Mat. Med., Ther., and Phar.," '96).

Thymol-camphor has been suggested as a preparation that would be valuable in dermatological practice, but has received, apparently, but little attention.

Used in pruritus of scrotum and in pediculosis pubis with apparently good results. Applied to the normal healthy skin, it does not cause any irritation or redness. Schaefer (Boston Med. and Surg. Jour., '96).

Menthol-camphor is very like the foregoing. It has been exploited for the treatment of catarrhal maladies, including "hay" asthma or fever, acute laryngitis, etc.

In hypertrophic nasal catarrh, with excessive and disordered secretion, a 25-per-cent. solution of the drug has given excellent results. It was equally effective in chronic hypertrophic rhinitis, as well as in eczematous and herpetic eruptions. Bishop (Kansas City Med. Index, Mar., '92).

Camphoric acid is one of many remedies introduced with a view to treating tuberculosis by destroying bacilli, but it has failed to fulfill the rôle laid down for it. Latterly it has been employed in a host of nervous diseases, and as a remedy against night-sweats, cystitis, etc., and

it has appeared to be of some value in the management of epilepsy.

Ordinary angina and catarrhal pharyngitis were much improved by gargles of ½- to 1-per-cent. solution; applied by brush or as a spray, in fourteen cases of laryngitis it gave excellent results. Proved gratifying in cystitis, but its inhalation in lung diseases was without noticeable effect. Hurtleib (Wiener med. Presse, Feb. 23, '90).

Camphoric acid is a preventive of the fever following intravesical and intra-urethral operations. Especially after Bottini's operation this complication appears to be frequent. Camphoric acid administered for several days before the operation in doses of 1 gramme (16 grains) three times daily will prevent the fever, unless some complication like epididymitis, etc., is responsible for the rise of temperature. D. A. Freudenburg (Gaz. degli Osped. e delle Clin., No. 38, 1903).

Camphor-oil has never found a definite place in medicine except domestically, and then for external use only. Latterly, however, a few spasmodic attempts have been made to give it place, and suggestions have been thrown out regarding its internal adminstration. It is a crude product of uncertain strength, and it can serve no purpose that cannot be better filled by a solution of camphor-gum in oil of sweet almonds.

Oxycamphor is a colorless, crystalline powder, soluble up to 2 per cent. in cold water. It may be administered in gelatin capsules. The daily amount may be as much as 30 grains. It is of value for the relief of dyspnœa due to pulmonary, cardiac, or renal disorders. Alfred Ehrlich (Centralb. f. d. gesammte Ther., H. 1, S. 1, '99).

CANCER. See TUMORS.

CANCRUM ORIS. See MOUTH, GANGRENOUS STOMATITIS.

CANNABIS INDICA SEU SATIVA.—Indian, European, and American hemp are one and the same, except as modified by locality, climate, soil, and culture. The plant attains its highest medicinal virtues when grown in the tropics or subtropics, inasmuch as here it develops a larger amount of resin (*churrus*). The dried flowering tops of the female plant are the parts employed medicinally, and it is essential to medicinal virtue that the resin be not removed; these tops in their crude condition are known as *gunjah*. The Arabian *hasheesh*, Hindoo *bhang*, and Mohammedan *majoon* are practically identical, being aromatic confections into which not only cannabis Indica, but the powdered seeds of stramonium, enter. *Hasheesh* is not, as has been stated, "the broken stalks of the hemp made up into fruits."

The chemistry of hemp is not well understood. The resin, or *churrus*, according to Egasse, is the active principle, and has received the name of "cannabin"; but Helbing gives this title to a supposed alkaloid of syrup-like consistency and brownish- or greenish- black hue, scarcely at all soluble in water, but freely so in ether and alcohol. Jahns insists that the only alkaloid is choline, and all other supposed principles are impure choline. Inasmuch as this same name obtains to a base found in plants and animals, formerly known as "sinhaline" and "bitineurine," and described chemically as oxy-ethyl-trimethyl-ammonium, its applicability is questionable.

Cannabindon is another derivative of hemp, and appears in the form of a dark, cherry-red syrup.

The cannabine alkaloid of Merck is had in fine needles, but its relations to the entire drug are not yet fully determined; it is not even known that it is a true alkaloid. So, too, there is found in market another "alkaloid" bearing the same title, and which is a translu-

cent, brown, syrupy liquid, with the hemp odor.

Cannabine tannate is a yellowish-brown powder with a tannin-like taste, not unpleasant smell, insoluble in pure water and ether, soluble in alcohol, and freely so in water made alkaline; it is said to be free from the two acrid and volatile oils peculiar to hemp and which are generally held to be rapidly-acting irritant poisons. Cannabinine is a yellowish-brown, syrupy liquid with an odor very similar to that of nicotine. Cannabindon is a purified churrus of dark-brown color, the consistency of treacle, and a most disagreeable taste; it is insoluble in water.

In the Orient churrus is smoked, and also manufactured into an intoxicating drink. A butter is also employed in the Hindoostani peninsula.

Preparations and Doses.—As a whole, cannabis is one of the most valuable of drugs, but is sadly handicapped by the uncertainty that attends all pharmacopœial preparations. Attempts to prepare by methods of assay have not been attended with any marked degree of success, owing to the fact that such have necessarily been based on the amount of the extractive. Too little is known regarding the so-called active principles to place any reliance on them as guides; consequently the sole dependence of the prescriber is the character of the manufacturer, and the ability of the latter to judge of the crude drug employed. For such reasons cannabis requires to be employed with judgment and caution. It has been noted, too, that larger doses are required in temperate climes than in the tropics and subtropics to produce a definite effect; but the real truth, doubtless, lies in the fact that the drug deteriorates with age and by transportation; perhaps loses some undetermined volatile constituent. The same precise preparation may prove active to-day; but, given to the same patient under equally favorable conditions a few weeks later, may prove practically inert. Honiberger observed that a resinous extract prepared for him in Calcutta was very much less energetic when he reached London.

Cannabis Indica abstract, $^1/_2$ to 4 grains.

Cannabis extract (solid), $^1/_4$ to 2 grains.

Cannabis extract (fluid), $^1/_2$ to 6 minims.

Cannabin (resin), 1 to 5 grains.

Cannabindon, $^1/_2$ to 1 minim.

Cannabine (alkaloid), $^1/_2$ to 4 grains.

Cannabin tannate, 2 to 15 grains.

Cannabine (liquid), 1 to 3 minims.

Cannabinine, $^1/_4$ to 1 grain.

Cannabis tincture, 5 to 30 minims.

Cannabis-butter, 2 to 8 grains.

Liquor cannabis (Lees's), 15 to 60 minims.

Physiological Action.—The alkaloids appear to be purely hypnotic in action; but all other preparations exhibit, in a general way, the action of the crude drug. Minute doses are sedative to the spinal centres, and even when frequently repeated exhibit little to be remarked, except, perhaps, there may be slight contraction of the pupils; but there is, nevertheless, inculcated a feeling of comfort and well-being, and not infrequently the drug appears to steady the action of the heart. Larger doses are stimulant; they first induce increased arterial action, followed by exhilaration, and, as the latter passes off, drowsiness or stupor succeeds, that may be almost cataleptic; but the awakening is free from *malaise*, nausea, headache, or other untoward symptoms; the pupil of the eye is expanded. The preliminary effect

is more powerful and lasting than that of opium, and the slumber it induces is commonly disturbed by dreams and spectral illusions. Also the sensory nerves are affected, as is evidenced by marked numbness and tingling, ushering in cutaneous anæsthesia and diminution of the muscular sense. Appetite is generally stimulated, and marked aphrodisia is not uncommon. Withal it is a valuable anodyne and antispasmodic, its influence being manifested through the brain and cord.

Cannabis Indica likewise exhibits a marked predilection for the genito-urinary apparatus, being strongly stimulant or sedative to the mucous tissue thereof in accordance with the mode of exhibition and size of dose; it is sometimes markedly diuretic, and appears to be excreted in part by the kidneys; but beyond this the eliminative process is unknown. Further, in atonic conditions or inertia during labor, it stimulates uterine activity and induces physiological contractions, and at a time when ergot and kindred remedies prove useless.

> The effects of cannabis Indica vary according to the manner in which it is taken into the system. When smoked, exhilaration is most manifest, while when taken by the mouth in small quantities this is generally not observed. Where an immedate effect is desired the drug should be smoked, the fumes being drawn through water. By the mouth, one hour to two hours are necessary before absorption occurs, but the effects are more lasting than when it is inhaled. The hemp when taken as an inhalation may be placed in the same category as coffee, tea, and kola. Used by the mouth it should be classified with the narcotics. No danger is to be apprehended while the heart remains strong and regular. Dixon (Brit. Med. Jour., Nov. 11, '99).

Poisoning by Cannabis Indica.—In large doses the drug appears toxic, and yet, strange to say, in spite of the enormous quantities (relatively) that have been ingested on certain occasions, either accidentally or purposely, a case of death directly referable to this drug has yet to be recorded.

> In a case after cannabis Indica in large dose the existence of muscular contractions was noted, followed later by convulsive movements, evidently due to action of the drug on the spinal cord. Aside from acceleration of the pulse-rate and feeling of fullness in the artery at the wrist, there was, just previous to the occurrence of unconsciousness, a sense of extreme tension in the abdominal blood-vessels: they felt distended almost to bursting. After some hours the urine was markedly increased in quantity. No constipation resulted. There was no foreboding nor fear of impending death. Robert C. Bicknell (Thera. Gazette, No. 1, p. 13, '98).

Treatment of Poisoning.—Cannabis is antagonized by caustic alkalies, vinegar and other acids, strychnine, electricity, antimonials, and blisters to the nape of the neck.

Therapeutics.—Hemp is soporific or hypnotic, anodyne, antispasmodic, nervine stimulant, and, as already remarked, in some measure diuretic, aphrodisiac, and oxytocic; consequently its scope of usefulness is a most extended one, particularly in nerve-maladies.

> Its most important effects are to be found in the mental sphere, as, for instance, in senile insomnia with wandering. An elderly person (perhaps with brain-softening) is fidgety at night, goes to bed, gets up, thinks he has some appointment to keep, that he must dress and go out; daylight finds him quite rational again. Here nothing can compare in utility to a moderate dose of cannabis. In alcoholic subjects, however, it is uncertain and rarely useful. In melancholia it is sometimes serviceable in converting depression into exaltation. In the occasional night-rest-

lessness of paretics, and the "temper disease" of Marshall Hall, it has proved eminently useful. In neuralgia, neuritis, and migraine it is, by far, the most useful of drugs, even when the disease has persisted for years; many victims of diabolical "sick headache" have for years kept their sufferings in abeyance by taking hemp at the threatened onset of the attack. It relieves the lightning pain of ataxia, and also the multiform miseries of the gouty. Again, in chronic spasm, whether epileptic or choreic, it is of great service; also in the eclampsia of both children and adults. In brain-tumors or other maladies in the course of which epileptic seizures occur followed by coma, the coma being followed by delirium,—first quiet, then violent, the delirium then passing into convulsions, and the whole gamut being repeated,—Indian hemp will at once cut short such abnormal activities, even when all other treatment has failed; but in genuine epilepsy it is of little avail. J. Russell Reynolds (Lancet, London, Mar. 2, '90; N. Y. Med. Jour., June 7, '90).

Cannabis Indica employed with good effect as a local anæsthetic to relieve dental pain. The tincture is diluted three to five parts with alcohol, and is introduced into the cavity of the tooth by means of a tampon of cotton. These tampons are also placed about the gum below the tooth. If the alcohol is too strong the tincture may be diluted by means of hot water. Aarousin (Jour. de Méd. de Paris, Oct. 30, '98).

Cannabis Indica may be employed in the solid extract, from 8 to 20 grains being given. With a few exceptions, its efficacy is limited to those diseases directly traceable to nervous derangement. Pain not due to distinct pathological lesions forms the chief indication for its administration, and relief is usually obtained promptly. H. E. Lewis (Merck's Archives, July, 1900).

In tetanus cannabis Indica has been found very efficacious at times, and in those cases wherein it is not curative it seldom fails to afford some measure of relief.

Hay Fever.—The usefulness of hemp in allaying morbid irritability of the nervous system is such that it has been suggested for employment in the form of vasomotor coryza popularly denominated "hay fever" or "hay asthma"; but there seems to have been no critical trial thereof. The idea, however, is both commendable and rational, and worthy of experiment. Cannabis is often efficacious in other asthmas, either given by the mouth or burned and its fumes inhaled.

Delirium Tremens. — In *delirium tremens* the drug is often most satisfactory; here its action resembles opium and wine, but is much more certain. It produces a great change of mind in the patients, readily dissipates the horrors, quiets nerve-hyperæsthesia, and conduces to cheerfulness; but great discrimination is necessary in application.

Uterine Hæmorrhage.—In menorrhagia and other uterine fluxes hemp is often invaluable if judiciously employed; and so, too, it may prove valuable in impending abortion. Mention has already been made of its power upon the gravid womb inactive through inertia, and it is equally efficacious as a preventive of post-partum hæmorrhage or as a remedy after "flowing" has begun, but requires to be given in full dose and sometimes in conjunction with ergot. Here half-drachm or even drachm doses of the fluid extract may be exhibited, since—strange to say—in such cases it never exhibits the ordinary physiological effects; there is no excitement, no intoxication, and no tendency to somnolence; only a feeling of quiet well-being, and that the condition is one of perfect safety.

Effect upon Reproductive Organs. —Cannabis, too, is especially available for sensitive ovaries. Indeed, it seems sedative to all the pelvic contents; and

it is thus that it acts as an aphrodisiac by allaying functional nerve irritation, not, as has been supposed, by stimulating erethism; and yet the latter effect may be had from large doses, but is apt to be most fleeting or else assume the form of a priapism in man and nymphomania in woman that is not gratified, much less satisfied, by sexual indulgence.

> It exerts a very marked effect upon the reproductive apparatus. In the early stages of gonorrhœa small doses combined with gelsemium will subdue the disease much sooner and more safely than the old method of ruining the digestive powers with large doses of copaiba and turpentine. Combined with gelsemium it subdues inflammation of mucous tissue. In spermatorrhœa in highly nervous subjects it is especially valuable. It will do good service combined with pareira brava in cases of irritable bladder. Goss ("Text-book of Mat. Med., Phar., and Special Ther.," '89).

Cholera. — In the Orient it is a favorite remedy for epidemic cholera; patients in actual collapse have revived after taking a full dose. It seems to stimulate the nervous centres at a period when their influence is all but suspended. It is by no means a universal panacea as regards this malady, and seems to little affect the dark races, probably because they are generally more or less habituated to its use.

Cardiac Diseases.—In violent palpitations of the heart the drug is often markedly remedial, especially when the non-utility of all other agents has been proved. The late Dr. Christison, of London, especially extolled it; he employed it in a large number of instances with unequivocal effect, and by its aid succeeded in relieving a case of twenty-one years' standing.

Skin Diseases.—In eczema and other cutaneous disorders accompanied with intolerable itching, cannabis gives relief when local treatment does not, but it must be employed in a way to secure its full and prompt effect.

> In skin diseases associated with intense itching, particularly senile pruritus, where local applications fail to relieve, cannabis Indica is often used with great benefit; and, though there are rarely any untoward manifestations, it is best, perhaps, to give at first in small doses and then gradually increase. Mackenzie (La Sem. Méd., No. 14, '94; Univ. Med. Mag., Dec., '94).

Digestive Disorders. — In certain diseases of the stomach and digestive apparatus the drug is often available, and preferable to opium, in that it does not inhibit (but, instead, increases) appetite; does not interfere with the secretions of either pancreas or liver, and does not constipate or check renal secretion.

> Cannabis Indica is very valuable in the treatment of gastric neurosis and gastric dyspepsia. It allays painful sensation and improves appetite. It has no action on atony or dilatation of the stomach, but is of great service in promoting stomach digestion in cases of hyperchlorhydria; in anachlorhydria it acts feebly. Intestinal digestion is also improved by its use. On the whole, it may be considered as a true sedative of the stomach, and it lacks the disadvantages that accrue to opium, bismuth, potassium bromide, antipyrine, etc. Germain Sée (Bull. Gén. de Thér., July 29, '90).
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> In anorexia following exhaustive diseases—where there is repugnance and intolerance of food in almost every form that is not relieved by acids, nux vomica, and bitters—from 5 to 10 minims of tincture of cannabis, or ¼ to ½ grain of the solid extract, given thrice daily before meals, often brings back the appetite in two or three days. In dyspeptic diarrhœa also, and the first months of true tropical diarrhœas, it is often of great service. Tropical diarrhœa is primarily and essentially a disease of the liver, and mercury should

be administered to medicate that organ, while the cannabis acts by diminishing the irritability and excessive peristalsis of the intestines. McConnell (Prac., London, Feb., '88).

CEPHALALGIA.—Many have praised the drug in the treatment of headache, even the severe forms attending cerebral growths, or where the cephalalgia is dependent on uræmic poisoning.

It is almost a specific for that continuous form of headache which begins in the morning and lasts all day, the pain being generally dull and diffuse, but marked by occasional exacerbations. Mackenzie (La Sem. Méd., No. 14, '94).

Cannabis Indica is an excellent remedy for megrim, or sick headache, and it is somewhat surprising that it is not more frequently employed; the extract may be given in doses of from $^1/_8$ to $^1/_2$ grain in the form of a pill. When the patient suffers constantly from headache, or is liable to an attack on the slightest provocation, a pill may be taken three times a day for many weeks at a time without the slightest fear of the production of any untoward effect. Should the patient not speedily obtain relief, care must be taken to ascertain that the extract employed is physiologically active. Excellent results are often obtained by administration of pills containing 4 grains of cannabin tannate, one being given three times a day after meals. Murrell ("Manual of Phar. and Ther.," '96).

Cannabis Indica is an invaluable remedy in the treatment of disturbances of the sensory centres. It is one of the best remedies in headaches of many kinds, and is especially useful in cephalic sensations so common in individuals of neurotic habit. Tincture or fluid extract preferred. Five to 10 drops of fluid extract may be taken on moist sugar, swallowed with a draught of water. Angel Money (Australasian Med. Gaz., Feb., 1900).

RHEUMATISM.—Here cannabis has been lauded for both its analgesic and curative effects, yet it is questionable if it deserves the encomiums bestowed; but it may tend to alleviate pain, and it also increases appetite and mental cheerfulness.

RESPIRATORY DISEASES.—It is also a capital sedative to the upper respiratory tract, and is a favorite factor in many cough-mixtures; Fothergill long ago commended its use in phthisis pulmonalis.

It most perceptibly relieves the cough; it aids by its stimulating and exhilarating qualities, and supplies a place that cannot be filled by any other drug. Lees (Med. Rec., vol. xlix, '95).

RENAL AND URINARY MALADIES.—It is also frequently recommended in Bright's disease where the urine is tinged with blood, and upheld as an almost specific for urethral spasm, for chordee, and the acute stage of gonorrhœa; also in gonorrhœa and vesical irritation, and in spermatorrhœa.

CANTHARIDES.—The blister-beetle, or "Spanish fly," a coleopterous insect, also called lytta, is collected in Russia, Sicily, and Hungary, but is also found in Spain, France, Germany, and other parts of Europe. Representatives are found in various parts of the world, notably in the Levant and eastward, in Senegal, Southern and Central America, and in Chile. The insect is about an inch long, perhaps one-fourth inch broad, flattish, cylindrical, with filiform antennæ; it is black in upper part, with long wing-cases, and has large membranous, transparent, brownish wings; elsewhere of a shining, coppery-green hue. The powder is grayish- or blackish- brown, containing green, shining particles, with strong, disagreeable odor and acrid taste; is soluble in alcohol. Cantharides is often adulterated, especially when powdered with other beetles, exhausted flies, and ground gum-resin euphorbium; but these can be detected, or at least surmised, by testing

for the yield of cantharidine, which should not be less than 4 per cent.; it rarely exceeds 5.5 per cent.

Preparations and Doses.—Cantharides, powdered, $^1/_4$ to $^1/_2$ grain—not fit to be employed in crude form.

Cantharides cerate, for blisters only.

Cantharides cerate (made with alcoholic extract), external only.

Cantharides tincture (5 per cent.), 1 to 30 minims.

Cantharides vinegar, external only.

Cantharidine, not employed.

Cantharidate of cocaine, $^1/_{800}$ to $^1/_{100}$ grain.

Cantharidate of potassium, $^1/_{400}$ to $^1/_{200}$ grain; hypodermically only.

Cantharidal collodion.

Cantharidal liniment.

Cantharidal oil, external only.

Cantharidal ointment.

Cantharidal paper (blister-paper).

Cantharidal plaster with pitch.

Cantharidal warming plaster.

The powder of cantharides is too acrid and irritating to be employed except in very minute doses or well covered by other substance, and, even then, preferably in capsules. Its chief employment is as the component part of cerates, liniments, ointments, and other epispastic galenicals.

CANTHARIDES CERATE, "blister-plaster," or "flying blister," is made by mixing 96 grains of finely-powdered "flies," 60 grains of yellow wax, 68 grains of prepared suet, 24 grains of resin, and 48 grains of lard, the whole, when thoroughly incorporated, being spread on a suitable piece of sheep-skin or adhesive plaster.

The "WARMING" PLASTERS are of two kinds. One is obtained by adding, to a strong infusion of 4 ounces of cantharides, 4 ounces each of oil of nutmeg, yellow wax, and pure resin; and then incorporating with 3 $^1/_4$ pounds of resin-plaster and 2 pounds of soap-plaster, the last two being previously heated; it should have a decidedly-yellow hue. The other, also termed cantharidal pitch-plaster, is composed of Barbadoes pitch, to which ordinary cantharidal cerate is added to the amount of 8 per cent.

CANTHARIDAL, OR "BLISTERING," COLLODION is a thick liquid formed by adding 1 ounce of pyroxylin (gun-cotton) to 20 ounces of the blistering liquid known as cantharidal liniment; this latter is obtained by macerating for twenty-four hours 8 ounces of cantharides in 4 ounces of acetic acid, then percolating the mixture with a pint of ether until 20 ounces are obtained. Another liniment is composed of 15 parts of cantharides in sufficient turpentine to make 100 parts.

CANTHARIDAL, BLISTERING-, OR EPISPASTIC PAPER is merely a good wax- or paraffin- paper coated on one side with a mixture of 4 ounces of white wax, 1 $^1/_2$ ounces of spermaceti, 2 ounces of olive-oil, 6 drachms of resin, 8 drachms of cantharides, and 6 ounces of water,—the whole heated together,—then adding 2 drachms of Canada balsam after rejecting the watery liquid.

By digesting 3 parts of cantharides in 10 parts of olive-oil for ten hours over a water-bath, CANTHARIDAL OIL is obtained.

CANTHARIDES OINTMENT is a mixture of 1 ounce of the flies with an equal amount of yellow wax and 6 ounces of olive-, cotton-seed, or peanut- oil.

The "VINEGAR" may be prepared by digesting, at 200° F., and subsequent percolation, 2 ounces of cantharides, 18 ounces of acetic acid, and 2 ounces of glacial acetic acid.

CANTHARIDINE, or cantharidal cam-

phor, is found in glistening rectangular prisms, which melt at 218°; heated higher it gives off a heavy, white, very irritating vapor, condensing unaltered to crystals. It is easily soluble in acetone, sulphuric acid, and glacial acetic acid, less so in chloroform (1 to 80), very little in 90-per-cent. alcohol, 1 to 500 in petroleum ether, and 1 to 5000 in water; the aqueous solution, though practically tasteless, is by no means devoid of vesicatory power even in the minutest quantities. Cantharidine is also soluble in fatty oils and gives an acid reaction to very sensitive litmus-paper; it volatilizes at 100°. It likewise combines readily with alkalies to form soluble salts. If nitric acid is added to cantharidinate of sodium, crystals of cantharidine are at once precipitated.

The foregoing paragraph sufficiently explains the formation of cantharidate of potassium, which, however, seems only to have had an ephemeral existence.

Cantharidate of cocaine is a mixture of cantharidate of sodium and cocaine muriate, and occurs as a white, inodorous, amorphous powder with a sharp taste, readily soluble in alcohol, ether, petroleum spirit, and hot water. Its uses are the same as those of the potassium salt.

Physiological Action.—All species of cantharides are powerfully irritant when applied to the skin, and likewise vesicant, these two properties depending upon the cantharidine. Internally the drug can be given properly only in the form of tincture, for obvious reasons (see Poisoning), though the powder is sometimes, though rarely, mistakenly employed; and even the tincture should be employed only in connection with copious diluents and demulcents. Suitably administered, the tincture is a stimulant diuretic, and it appears also to exert a specific influence upon the mucous membrane of the genito-urinary system, particularly the neck of the bladder. In larger doses it is highly irritant, and it is not an uncommon accident for sufficient of the drug to be absorbed during applications to the skin to cause great irritation of the kidneys, as evidenced by painful micturition and bloody urine.

> The inflammation produced by cantharides begins in the glomeruli and not in the straight tubes. The first condition of the kidneys noticed after the administration of the drug is extravasation of leucocytes into the glomeruli and an exudation of a fibrous matrix. This is followed by filling of the glomeruli and the proximate tubules with a granular fluid, after which comes swelling of the cells of the capsule. Next in order swelling of the cells of the collecting tubes and of the whole urinary tubule is observed; and in the last stage multiplication of the cells of the straight collecting tubes which are thrown off so that their lumen becomes filled with exuded cells. Murrell, Lond. ("Manual of Mat. Med. and Therap.," '96).
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> Lahousse finds that cantharides affects simultaneously the Malpighian bodies, the renal tubules, and the matrix of the kidney. The Malpighian vessels are greatly congested; albumin, leucocytes, and a few red corpuscles escape; the epithelium covering the vessels lining the capsule swell and desquamate; the endothelium of the vessels swells and may choke their lumen, the tubule-cells swell, become granular, and die. The tubules contain hæmoglobin in the form of brilliant-red homogeneous cylinders. Leucocytes escape into the matrix. Other observers hold that the Malpighian bodies are alone, or chiefly, affected. Ringer and Sainsbury ("Handbook of Therap.," '97).

Cantharidal Poisoning.—The drug in non-medicinal doses is an acrid, corroding poison, the chief symptoms being a burning sensation in the throat, violent pains in stomach and bowels, nausea,

vomiting, and purging,—the dejections being frequently bloody and purulent,—great heat and irritation of the urinary organs, sometimes accompanied by painful erethism, and in the male painful priapism, quick and hard pulse, laborious breathing, convulsions, tetanus, delirium, and syncope. The morbid appearances are principally inflammation and erosion of the stomach. If the flies or powder have been ingested, characteristic *débris* will be found adhering to the mucous coat of the stomach and intestines, and, if recent, mixed with the contents of the *prima viæ* generally; powder of cantharides has been identified in the stomach nine months after death; there are also discoverable the marks of violent inflammation throughout the urinary organs; but such are usually most prominent when the poisoning is not fatal. The kidneys are frequently gorged with blood, as is the brain.

Treatment of Cantharidal Poisoning.—There is no known antidote for this drug, and all toxic cases require to be treated in consonance with the indications afforded by each individual case; it frequently can be little beside palliative. The promotion of free vomiting is generally imperative, further fostering by means of warm demulcents and diluents; diluents are in order even after emesis has accomplished all possible. Bland oils have been suggested, but these are dangerous, since they are apt to separate the cantharidine, which is very soluble therein, and thereby enhance and hasten toxicity. Opium, even chloroform by inhalation, is sometimes demanded to allay the excruciating suffering or to control convulsions. Opium enemas and frictions also will find place. Camphor often alleviates the most distressing symptoms, and bromides may be required. The smallest amount of tincture known to have induced fatality is 1 ounce; of the powder, 48 grains.

Case of cystitis caused by the use of cantharides as a blister. The symptoms were of considerable severity. Monobromated camphor was given both by the mouth and by enema; but no relief was obtained. The condition, however, yielded promptly to the influence of cocaine. Albarran (Lancet, Lond., Dec. 12, '92).

Therapeutics.—The internal administration of cantharides finds less favor than it did half a century back, doubtless because of the many accidents that have followed its employment. Some years ago the tincture was lauded as a powerful depressant, contrastimulant, and antiphlogistic, and advised to be used in acute inflammation, but even the Italian physicians, who were the strongest supporters of the drug in this connection, soon abandoned it for other and more safe medicaments. At present it finds its chief employment in the management of genito-urinary disorders, and, among French physicians, in diseases of the skin and scalp. The late Dewees considered the tincture in doses of 10 minims, gradually increased to twice or thrice this amount, to be an absolute specific in amenorrhœa; but how he avoided symptoms of strangury, when administering the larger doses, considering the potent nature of the remedy, is something of a mystery.

Incontinence of Urine.—Where this depends upon an atonic state of the bladder, the tincture may often be given with excellent effect; it appears to act locally, stimulating the parts and restoring a healthy tone to the bladder.

Small doses of cantharides may be relied upon to cure the slight incontinence of urine which, with women, is frequently associated with paroxysmal cough. Half a drachm is prescribed

with 4 ounces of water, and of this a teaspoonful is taken hourly. It rarely fails to effect a cure in twenty-four hours. Murrell, Lond. ("Manual of Mat. Med. and Therap.," '96).

Women, especially middle-aged women, often suffer from a frequent desire to pass water, or an inability to hold it long; sometimes this occurs only in the day on moving about. In these cases micturition may cause no pain, neither is there likely to be any straining, sneezing, or coughing. Sometimes both sets of symptoms are present, due apparently to weakness of the sphincter of the bladder. One or two drops of tincture of cantharides, three or four times a day, will, in many cases, afford great relief to these troubles, and sometimes cure them with astonishing rapidity, even when the symptoms have lasted for months or years. Ringer and Sainsbury ("Handbook of Therap.," '97).

Urinary Suppression. — The drug has also been recommended as a remedy for suppression of urine, but on what physiological grounds it is difficult to imagine; the evidence afforded is too flimsy to be worthy of consideration from even an empirical stand-point.

As an Aphrodisiac.—In the treatment of impotence the drug has, especially of late years, received its greatest employment, and the affirmative evidence is not without weight, though many have experienced nothing but failure from its use. Sloughing of the penis may occur from the employment of cantharides, even in what are deemed safe medicinal doses.

Internally employed, rarely, in doses of 4 to 10 drops three times a day in a mucilaginous mixture for impotence; but must be used carefully because of the danger of causing albuminuria. Roth ("Mod. Mat. Med.," '95).

Emmenagogue and Abortifacient. —Both these properties are claimed for cantharides, and it is generally admitted that the claims possess a measure of truth, but also that its employment for either purpose is little, if any, less than criminal. Sloughing of the labia is a frequent result from this use of the drug.

Urethral, Prostatic, and Cystic Maladies. — The drug has been employed in all these conditions with, at times, very apparent benefit; but that its application is by no means universal is evidenced by the fact that it frequently fails. The conditions when it is likely to prove of value, therefore, require to be carefully considered and studied out. It certainly is of no value, of itself, in syphilis, but given in conjunction with mercury salts it materially enhances their activity.

After its separation by the kidneys cantharides acts as an irritant to the urinary tact, and it may be employed for this action in cystitis, in gonorrhœa, and in gleet. One drop of the tincture, though 5 are sometimes required, should be given three or four times a day; this treatment is particularly useful in cases where there is a frequent desire to make water, accompanied by great pain in the prostate gland and along the urethra, while at other times severe twinges of pain are felt in the same parts. The urine, under these circumstances, may be healthy, or it may contain an excess of mucus or even a small amount of pus. A drop of the tincture, three times daily, will, in the majority of instances, abate or remove chordee. Ringer and Sainsbury ("Hand-book of Therap.," '97).

Diseases of Kidney.—*As a Diuretic.* —A half-century ago, on the Continent of Europe, tincture of cantharides was largely employed in albuminuria, beginning with small doses and gradually increasing to 60 minims, and it is authoritatively declared that this procedure was often attended with decided benefit; the caution is given, however, that it is not always successful, and that, moreover, it is a dangerous remedy in the hands of the inexperienced. In granular disease

of the kidney, too, the drug has been most favorably mentioned, particularly by Copland, the author of a famous "Dictionary of Practical Medicine."

The drug is powerfully diuretic under certain conditions, but is not a desirable remedy to exhibit by itself; it is a most valuable adjunct to digitalis, however, when this latter remedy is employed for the express purpose of promoting diuresis.

Scurvy; Chronic Whooping-cough.—These are two more maladies for which the drug has been employed, but with no apparent success; and in whooping-cough it has never appeared to be of benefit except when combined with cinchona and opium.

Skin and Scalp Diseases.—In lepra, eczema, and psoriasis cantharides still is in considerable repute, but does not secure the same degree of form that accrued to it in the latter part of the last, and early part of the present, century. It is advised that the tincture be given in 3- to 5-drop doses, three times daily, the amount to be increased by 5 drops every six or eight days, until the limit of tolerance has been reached.

Ear Diseases.—In deafness depending upon a thickened state of the drum-membrane, and where there is much irritation of the external meatus, many practitioners in the past believed they had secured great benefit by applying a strong cantharidal ointment—1 to 2—below and behind the ear thrice daily.

Nervous and Spinal Disorders.—In epilepsy cantharides has been favorably mentioned, and was at one time held in considerable esteem by the older practitioners, but it does not appear to possess any special virtues in this direction. It has, however, sometimes seemed to be of marked benefit in paraplegia, but only when it exercised a diuretic effect. Also it is often available when there is serous effusion into the vertebral canal, as in spinal dropsy, and both its internal administration and application externally in the form of blistering cerate tends to promote absorption of the effused fluid.

Respiratory, Cardiac, and Dropsical Maladies.—Cantharides is occasionally administered internally with benefit in passive dropsies with a view of stimulating the action of the kidneys, but it is inadmissible in sthenic or acute cases; it should be administered in conjunction with some other diuretic, however, such as a decoction of broom, infusion of digitalis, or sweet spirit of nitre. In the form of blister the cerate is also useful in these maladies, as well as in pericarditis, pleuritis, pneumonia, and more rarely phthisis.

Within a few years the cantharidate of potassium has been employed as a remedy for pulmonary and laryngeal tuberculosis, on the strength of some experiments undertaken by Liebreich; also the cantharidate of cocaine. Liebreich's theory is that the inflammatory processes set up by the cantharidin produce a transudation of sanguineous microbicidal serum.

> The chief points to be decided are whether cantharidinates have any action on diseased, particularly tuberculous, tissues, and, if so, whether this effect is obtained before any disturbance is produced in other organs, such as the kidneys. The cantharidinate gives rise to an increased exudation from the capillaries; hence its beneficial action; but there is no hyperæmia. Advanced tuberculosis, however, should be treated with extreme caution, for the kidneys are often fattily degenerated. Improvement has been recorded in other than tubercular processes,—*e.g.*, in chronic laryngitis. Any local application of a cantharidinate is not rational, as it only produces irritation. In hundreds of in-

jections made, there has been no more danger to the patient than from the use of mercury or arsenic. Liebreich (Therap. Monat., June, '92).

Recently, Liebreich and others have recommended the subcutaneous use of cantharidin in combination with alkalies in the treatment of tuberculosis. While the value of this method is still undetermined, the accumulated testimony gives little encouragement for its employment in this affection. In pneumonia, pericarditis, etc., cantharides is a most useful vesicant.

Blisters.—These are applied to establish a degree of inflammation or irritation on the surface of the body, and thus to substitute a mild and easily managed disease for an internal and intractable one, on the principle that two sets of inflammation cannot be carried on at the same time: a theory that admits of some question; to stimulate the absorbents and thus cause the removal of effused fluids; to act as derivatives; to stimulate the whole system, and raise the vigor of the circulation. A few rules find universal application as regards the use of these agents, viz.: Never apply a blister at the beginning of inflammation,—never until the acute stage has been subdued by other means. Never apply where the skin is thin or tender nor over a bony prominence, as great irritation will result, and the healing will be slow and difficult. In many instances, as in acute laryngitis, it is not advisable to apply a blister directly over the seat of the disease, as it sometimes aggravates the symptoms; indeed, a blister is often more efficacious if applied at a remote point, as to the heel in sciatica or lumbago. As a rule, it is not advisable to allow a blister to remain on the part to which it is applied more than two or three hours,—only until it has produced considerable redness, when the process may be completed by soft, warm poultices. A blister has been known to produce abortion when applied to the neck or chest of a pregnant woman. Blisters applied to a scorbutic person are apt to induce ulceration and gangrene; and the same is, in a measure, true as regards this application to children, who, as a rule, bear vesicants badly. Finally, the danger of absorption of cantharides from cantharidal vesicants, sufficient to induce untoward phenomena, and even toxicity, should always be considered. Violent strangury has resulted in some instances from the application of a blister to the penis with a view of preventing masturbation.

CAPILLARY BRONCHITIS. See Pneumonia, Catarrhal.

CARBOLIC ACID. See Phenic Acid.

CARBUNCLE. See Surgical Diseases of Skin.

CARCINOMA. See Tumors.

CARDIAC ANEURISM. See Aneurism.

CARTILAGINOUS TUMORS. See Tumors, Enchondroma.

CATALEPSY.—From Gr., *κατάληψις*, seizure.

Definition.—Catalepsy is not a distinct disease, but a symptom of a disordered condition of the highest nerve-centres: the cerebral cortex. During the attacks, which are intermittent, the nervous system, especially the lower, is

in an excitable state; the higher centres have lost control over the lower; the face at times is as passive and expressionless as that of a marble statue, while in some cases the face seems to indicate mental agitation; there is impairment, or apparent loss, of consciousness, volition, and sensation; the patient lies, sits, or stands with muscles in a state of tonic or rigid immobility, and if the head or limbs are placed by an attendant in awkward, or what are usually uncomfortable, positions, they may remain so for an indefinite period, minutes or hours, without any apparent voluntary effort or evidence of fatigue on the part of the patient.

All these manifestations represent but a series of nervous phenomena indicating a deranged condition of the normal functioning power of the general nervous system; we are therefore prepared to learn that in a few cases it may be the only obtrusive evidence of disease; that it may occur associated with hysteria, or that it probably may be one of the manifestations of this affection; that it may be an epiphenomenon of certain organic diseases of the brain, such as abscess, tumor, softening, meningitis, hæmorrhage, etc.; that it may be found in epilepsy, insanity, chorea, or, in fact, in almost any condition of the nervous system in which the inhibitory or controlling power of the higher nerve-centres over the lower is greatly impaired or lost during the attacks.

Varieties.—As to the varying conditions under which the phenomena may be manifested, with modifications of the symptoms in different cases, those who have regarded catalepsy as a distinct disease, *sui generis*, have spoken of "true" and "false" catalepsy: *catalepsia vera* and *catalepsia spuria*. With most of these writers there is but one form of catalepsy: that in which the limbs or any flexible portions of the body present a condition likened to a figure of soft or easily-molded wax (so-called *flexibilitas cerea*), in which the parts, without any apparent voluntary effort on the part of the patient, remain for an indefinite time in the positions in which they may be placed.

My individual impression is that catalepsy, unassociated with organic disease, denotes an hysterical condition, and is then one of the numerous manifestations of hysteria or an affection closely allied to it. In some cases the cataleptic phenomena may be the only evidence of disease, but this is so rare that some observers have never met with an example.

> It may probably be placed between epilepsy and hysteria in the scale of maladies, but nearer the latter than the former, and, as regards the nature of its chief feature, it may be regarded as essentially one of the motor. But there is also distinct interference with the intellectual processes, and interruption of the connection between the will and the motor centres. W. R. Gowers ("Quain's Dic. of Med.," vol. i, p. 285).
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> [It is no more surprising that catalepsy should occur from organic disease of the brain than that hysteria should manifest itself under similar circumstances, and, in some instances, become so prominent as to lead the unwary observer to mistake a tumor or some other lesion for the functional disturbance. Indeed, it seems to me that this is another reason for regarding catalepsy as one of the manifestations of hysteria or its twin-sister. In Colorado hysteria in its exaggerated forms is almost unknown. During a residence of fourteen years in this State I have not met with a single case of catalepsy in which the cataleptic phenomena were prominent or constituted the sole evidence of the nervous disturbance. During my residence here my practice has been almost entirely limited to the diseases of the nervous system (mental and physical), and I

have seen cases from nearly every portion of the State, and many from the adjoining States and territories. If other observers shall find that so-called true catalepsy is only found in places favorable for the development of hysteria in its most pronounced type, it will show, at least, that the phenomena of the former are closely associated with those of the latter, if, indeed, they are not a part of them. Further, the course, duration, prognosis, and treatment of catalepsy are almost identical with those of hysteria. J. T. ESKRIDGE.]

I shall first endeavor to give a description of the cataleptic phenomena in cases in which they occur as the principal or only symptoms of the nervous disorder, then as they are found associated with other, and often graver, nervous derangements.

Symptoms.—The symptoms of catalepsy are not easily described, as the phenomena observed are seen under so many different conditions. In a very few cases the cataleptic phenomena are the only obtrusive evidences at the time of the attack of a disordered state of the nervous system; in a second class the symptoms of hysteria are so pronounced that it is difficult to determine which is the real affection; in a third the cataleptic phenomena form a part of a graver disease, such as insanity, epilepsy, or organic trouble of the brain; in a fourth the nervous symptoms are the results of certain poisons or toxæmic states; and finally in a fifth the peculiar nervous disturbances are a part of the phenomena witnessed in a state of hypnosis which has been introduced by a method that greatly agitates and excites the higher nerve-centres. I shall first try to give a description of catalepsy as free from complications as possible, then will follow references to cataleptic phenomena as met with in association with other nervous disorders.

Catalepsy is essentially a paroxysmal or intermittent affection. For its development in its typical form it probably always requires on the part of the subject a certain predisposition, an unstable and excitable nervous condition, a tendency to hysterical manifestations, most prominent among which is hypersensitiveness of some of the special senses. The paroxysms vary greatly in their severity and duration. The pronounced symptoms usually come on suddenly, but these are often preceded by headache, slight hysterical manifestations, giddiness, gastric symptoms, or hiccough. The special symptoms are ushered in by all or part of the voluntary muscles suddenly becoming rigid, the limbs remaining in the positions in which they were arrested by the onset of the attack.

In some cases the arm stops in the act of carrying a cup to the mouth; the latter remains open and the whole body assumes a fixed position, as if petrified. At first the muscles are quite rigid and resist strong passive motion; but soon the rigidity is followed by a soft, wax-like state of the muscles. The limbs may then be placed in various positions by moderate passive motion, and in these they will remain for several minutes, or even for hours in some cases. If an arm or a leg is placed at a right angle with the body, with no support except that given by the muscles in a state of increased tension, it would be maintained in this uncomfortable position for a considerable length of time; but after awhile the limb from force of gravity begins gradually to descend. Two important observations may be made at this stage of the attack that have considerable diagnostic value. One is that the patient's features and respiration show no evidence of fatigue or voluntary effort, and the other is that if a

weight of a few pounds is suspended to the limb, or passive motion is exerted to overcome the tension of the muscles that hold the limb in its position, the member gradually descends, without any extra effort being exerted to keep it from falling. Consciousness is always impaired, and sometimes apparently completely lost, from the first. The degree of disturbed consciousness varies in different cases. In some cases it seems to be completely abolished.

[I think Dr. C. K. Mills is right in cautioning against haste in believing that unconsciousness is complete in a given case. J. T. ESKRIDGE.]

In a few cases in which the cataleptic condition of the muscles is well marked the patient makes no attempt to answer questions or to move when the skin is irritated, because volition is in abeyance; but the patient may know everything that goes on around her. The pulse, temperature and respiration are slightly changed. The pulse is slow or normal; the temperature is usually a little subnormal; sometimes it is one or several degrees below the normal; respiration is quiet, shallow, and sometimes almost imperceptible. The face is pale, the eyes wide open and looking horizontally forward. Sometimes the lids are partially or gently closed. The pupils are dilated, often react to light slowly, but in some cases they show no response. The fundi and optic nerves have been found anæmic, according to W. A. Hammond. The features frequently present a blank or placid appearance, but in some cases they show evidences of mental agitation. The skin is often very cool and pale, especially if the paroxysm is prolonged; this with the almost imperceptible respiration and expressionless features, open eyes, and dilated pupils—give the patient the appearance of death, for which catalepsy is said to have been mistaken.

Cutaneous sensibility is often abolished; in some cases it is only impaired; rarely a condition of hyperæsthesia has been observed. The cornea, conjunctiva, and pharynx may present no evidence of sensation, or they may retain partial sensibility; so that the eyelids will close when the eyeball is touched, and the reflex of the pharynx may be obtained. In some cases the power of deglutition is said to have been lost, but, more commonly, when the food is placed on the posterior portion of the tongue it will be swallowed. The deep reflexes are usually lessened; they are rarely increased, and in some cases absent. They may be present on one side and absent on the other, although the wax-like condition of the muscles is bilateral. The functions of the special senses seem to be impaired or abolished, although in some cases it is possible to elicit a response from the patient by stimulating the organ of hearing, and occasionally that of sight. The electrical reactions of the muscles and nerves have been found normal, lessened, and in exceptional cases increased.

The paroxysms, even if prolonged, do not remain at their height for a great length of time. They may last only a few minutes, hours, or in rare cases days. In the prolonged attacks there are usually intermissions or remissions, during which the patient completely or partially arouses for a few minutes and then relapses. Hammond says the paroxysm generally disappears as abruptly as it began. "A few deep inspirations are taken, the eyes are opened, or lose their fixedness, the muscles relax, and consciousness is restored, but no knowledge of what has occurred is retained." It is probable that in the majority of

cases there is gradual restoration to consciousness, the patient remaining bewildered and stupid and the muscles more or less rigid during the emergence from the cataleptic state. Eulenburg states that in some cases the attacks may disappear quite suddenly. "The patients recover at once full consciousness and the normal use of their muscles, take up their employment which had been interrupted, continue the sentence previously commenced, and conduct themselves as if not the slightest thing had intervened."

[I have seen a few such cases, but I have looked upon them as epileptic in character, and of the variety known as *petit mal*. The subsequent course of two of these has shown that my apprehensions had been well founded. J. T. Eskridge.]

Continuing, Eulenburg says: "Much more frequently the patient's recovery is only slow and gradual; they are at first somewhat stupid, as if awakening from an unusually sound sleep. Sensibility is still diminished, the power of the will weakened; a certain amount of the stiffness of the muscles still remains for some time, which renders motion difficult and slow."

The frequency of paroxysms varies greatly in different cases. One or more attacks may occur in the twenty-four hours; they may be repeated every few days, weeks, or months. Just as we find in epilepsy, so we not infrequently observe in catalepsy, that if the paroxysms return every few weeks or months several attacks may occur at these times within a period of a few days. In rare instances only a few paroxysms are observed during life-time, separated from each other by a period of years, as we find in some cases of epilepsy. In still more exceptional cases only one attack occurs.

During the interval of the attacks little or nothing may be observed to distinguish the subject from a normal person. More commonly, especially when the paroxysms occur frequently and with any regularity, the patient is irritable, nervous, hysterical, and complains of lassitude, and sometimes of dizziness and headache, during the interval of the attacks.

Complications and Concomitant Disorders.—The complications, or, better, the disordered conditions of the nervous system which the phenomena of catalepsy may complicate, are numerous.

Hysteria and catalepsy are so nearly alike in many of their phases that it is not always possible to draw any distinct line between the two affections. The cases complicated by hysteria may present one of the following conditions: All the phenomena of catalepsy may be present, but in addition thereto there may be numerous and pronounced symptoms of hysteria, both during the attacks and in the intervals; or the seizures may be so typically hysterical that were it not for the symptoms of catalepsy at the time of the paroxysms the case would be termed one of pure hysteria. In fact it is such, with the phenomena of catalepsy added. Such cases are usually chronic, little influenced by treatment, and the patient during the intervals between the paroxysms may present all kinds of hysterical symptoms, even convulsions.

What has been said in regard to catalepsy complicated by hysteria applies in no small degree when this affection is associated with trance, ecstacy, somnambulism, and certain forms of somnolency. These are all nearly allied to hysteria when they are due to a functional disturbance of the nervous system.

Catalepsy often occurs in association with epilepsy, chorea, insanity, or or-

ganic diseases of the brain. In *chorea* cataleptic phenomena have been met with, and in some instances these have been quite pronounced with states of automatic action resembling certain phases met with in hypnotism especially in children. *Epilepsy* may be associated with cataleptic symptoms, but we should be careful in the study of these cases to determine whether the latter are not evidence of true epilepsy. In those cases of supposed catalepsy in which consciousness is suddenly recovered and the patient immediately returns to the normal condition, finishes the employment which had been begun before the attack, or continues a sentence that had been interrupted, and acts as though nothing had happened, it is quite probable that the symptoms are epileptic in character.

[Dr. Thomas King Chambers says: "Catalepsy is sometimes very brief and sudden. I have a young lady now under my care, for non-assimilative indigestion, of whom I received the following accounts from a mother of more than ordinary intelligence and power of observation. She said that her daughter was fond of reading aloud, and that sometimes in the middle of a sentence the voice was suddenly stopped, and a peculiar stiffness of the whole body would come on and fix the limbs immovably for several minutes. Then it would relax, and the reading would be continued at the very word it stopped at, the patient being quite unconscious that a parenthesis had been snipped out of her sentence, or that anything strange had happened. She grew much better under tonic and restorative treatment, and gradually ceased to have these singular attacks; but after about a month's interval, as she was one evening engaged in playing a round game of cards, she suddenly went off into a regular epileptic fit, which was followed by sleep, and she did not recover consciousness till the next morning. This fit could be accounted for by certain errors in digestion, and she has had no recurrence of it, or of the catalepsy, though four months have passed over. So I hope it was epilepsy of an intercurrent or curable sort." One feels that this must have been a vain hope, and, had the history been subsequently continued for a period of a year or more, it would probably have shown that the case was one of epilepsy, and not of the "curable sort." The next case that he reports is more serious. "But sometimes the epilepsy preceded by catalepsy is of a more serious sort. I remember a much-respected lecturer in this metropolis in whom the *petit mal* of epilepsy assumed this form. He used to be attacked sometimes in the middle of a sentence, with his hand wielded in demonstration before his class. He would remain perfectly stiff for a minute or so, with mouth open and arm extended, and then resume his sentence just where he had dropped it quite unconscious that anything had happened. After a time the seizures assumed the more usual and more fatal form." (Reynolds's "System of Med." [Hartshorne], vol. i, pp. 654-55). I have seen several cases of epilepsy, especially in children, the first symptoms of which simulated those of catalepsy. J. T. Eskridge.]

Cataleptic symptoms in eight rachitics aged from eighteen months to three and one-half years. The phenomena were manifested by the persistence of the position given to a limb. When the leg was raised, for instance, it was maintained in this position for a long time, often as long as fifteen to twenty minutes, in one case even as long as forty minutes and then falling very slowly. If the position of the limb or parts of it was changed, even to a very uncomfortable attitude, the immobility would be maintained for an equal period of time. This phenomenon was more constant and distinct in the leg than in the arm. There was no tremor in the limb; during this cataleptic state the reflex excitability seemed diminished. Epstein (Revue Men. des Mal. de l'Enfance, Jan., '97).

Insanity, especially stuporous insanity, the graver forms of melancholia, catatonia (of Kahlbaum), and paretic de-

mentia may be associated with cataleptic conditions. These are most typically seen and most frequently met with in catatonia, in which increased motor tension is one of the diagnostic symptoms of the disease. In the other forms of insanity the cataleptic phenomena seem to be accidental. Their presence in any form of insanity indicates profound nutritional changes, and therefore adds gravity to the prognosis. Cases of *organic disease of the brain* only infrequently present symptoms somewhat similar to catalepsy. Cases of tumor, abscess, hæmorrhage, softening, traumatic injuries of the brain, and of meningitis, especially of the tubercular variety, have presented temporary symptoms of catalepsy.

It is important to bear in mind that organic disease of the brain may be the cause of cataleptic phenomena, lest an organic lesion should be mistaken for an affection that is functional in its nature.

Chloroform or ether narcosis; opium poisoning in extremely rare instances; and certain toxæmic states, probably from autoinfection, may cause conditions simulating catalepsy. It is so rarely that one meets with a case of opium poisoning in which convulsions or cataleptic phenomena are present that were the physician not on his guard there would be great danger of mistaking the case for a lesion of the pons, or some condition other than that caused by a lethal dose of opium.

Hypnosis and *catalepsy* need no discussion here, further than the statement that many of the cases of catalepsy reported as occurring in very young children of two or three years of age present symptoms somewhat similar to those seen in hypnotized subjects, especially in those in which the hypnosis has been induced by the Charcot method, such as having the subject stare at a bright object, held in such a position as to cause the eyes to converge and look upward. Unilateral cataleptic phenomena are often seen in hypnotic subjects. It may often be developed at the will of the hypnotist.

Diagnosis.—"The peculiar rigidity of catalepsy is characteristic, invariable, and renders the diagnosis a simple matter," says Gowers. In the last edition of his great work on "Diseases of the Nervous System" the writer states that "the diagnosis of catalepsy presents no difficulty." That the peculiar rigidity and wax-like flexibility must be present before we are justified in making a diagnosis of true catalepsy, I think, will be accepted by almost every clinician, but that these conditions may be present as prominent symptoms in certain grave diseases of the central nervous system, and possibly mislead the physician in mistaking the cataleptic phenomena for the real disease, must also be borne in mind. In the face of the possibility of the occurrence of such an error, it seems to me that it is the first duty of the physician in the diagnosis of catalepsy, as it is in hysteria, to determine whether the cataleptic phenomena are caused by some organic lesion. The same principle holds good here as applied to hysteria. The presence of numerous symptoms pointing to a functional affection of the nervous system is of less importance in the diagnosis than the detection of one positive symptom of an organic lesion. All cases of catalepsy should be carefully studied and the patient systematically examined lest organic disease escape detection.

Trance, somnambulism, ecstasy, or hysteria in its ordinary form is readily distinguished from catalepsy on account of the wax-like flexibility in the latter.

Should cataleptic subjects go into a trance, or an hypnotic state, or become ecstatic, or hysterical, the presence of the characteristic symptoms of catalepsy would probably determine the diagnosis in favor of the latter affection. There might be danger of mistaking a case of catatonia for catalepsy were one not on his guard. Of the former, Spitzka says: "The most striking phenomena of the disorder are its cataleptic periods. The catalepsy is typical and extreme. For days, weeks, nay months, the patients are immobile, resembling sitting corpses, requiring to be fed by the stomach-pump, to be carried to and from their beds, and betraying neither by look nor word that they have any mental activity left."

> Case of a patient who was, on one occasion, placed with one foot on the ground and the other on the bench behind him, head flexed extremely, one arm raised to the horizontal position before him and the other in the same position behind him. The patient remained in this awkward, and what would be for a normal person impossible, position for an hour or more before his arms began gradually to descend. In another case the patient retained any possible position in which he was placed for a day at a time. The history of the case, which would show a pathetical emotional state, with a tendency to repetition of certain words and phrases, together with the prolonged cataleptic periods serve to determine the nature of the case. Spitzka ("Insanity").

There is little danger of mistaking catalepsy for the other forms of insanity with which it may be associated. In hysteria uncomplicated with the cataleptic phenomena, the local position of the spasm and the absence of the wax-like condition of the limbs would distinguish it from catalepsy. In hysteria when the limbs are rigid they cannot be flexed without using considerable force. The peculiar position of the hands in tetany and the resistance offered by the muscles to putting the limbs in different positions would prevent mistaking this affection for catalepsy. There is probably no danger of confounding catalepsy for epilepsy if the paroxysms are observed by a person of intelligence, except in those cases of the latter disorder in which the initial symptoms closely resemble catalepsy. A sudden return to consciousness after the exhibition of cataleptic symptoms, the patient resuming his work at the point at which it had been left off or continuing a sentence from the word at which the interruption had occurred, just as if nothing had happened, is strongly suggestive of epilepsy.

Catalepsy may be feigned. Of course, it is an easy matter for a person to breathe quietly, and allow his limbs to be placed in different positions, as if they were made of soft wax, but it is not possible for one to maintain awkward and uncomfortable positions for a considerable length of time without the breathing, the appearance of the face, and the jerky tremor of the muscles showing evidence of fatigue. In catalepsy if a weight of several pounds be attached to the outstretched arm or slight force is employed to depress it, the limb will gradually descend to the side of the body without the person showing any evidence of effort to keep it from falling. Simulators, on the other hand, invariably endeavor to prevent the limb from being carried down by force.

Finally, catalepsy is said to have been mistaken for death. The waxy flexibility of the limb is never found after death. Anyone who has employed the ophthalmoscope to examine the optic nerves after death can never mistake the ap-

pearance of these and the whole fundi. Everything is blanched and bloodless. In the absence of the ophthalmoscope the stethoscope may be employed to detect the heart's action; a glass mirror may be held before the mouth and nostrils to determine whether the patient is breathing; the temperature of the body may be taken, but this, like the use of electricity, is not of much value to ascertain whether the patient is dead or alive, unless some hours have elapsed to allow the temperature of the body to fall and electrical changes to take place. Of tests for death, immediately after its occurrence, there is none, in my experience, equal to the use of the ophthalmoscope.

Prognosis.—Hammond thinks the disease does not, in the vast majority of cases, tend to become worse either in regard to severity or frequency of the paroxysms, especially in those cases in which the exciting causes are removed. Catalepsy due to malaria is curable. When the affection is the direct result of temporary emotional disturbance and the neurotic element of the subject is not too profound, a cure may take place. It is in this class that we sometimes meet with only one, or a few, attacks during a life-time. Traumatism to the head or spine may give rise to catalepsy that may be only temporary in character. In the majority of cases catalepsy, like hysteria, is a chronic affection and may last months, years, or even a life-time, with few or many paroxysms, depending upon modifying circumstances, especially education, the *morale* of the patient, the frequency, intensity, and character of the exciting causes. Catalepsy is probably never the direct cause of death.

Etiology.—The causes of catalepsy are predisposing and exciting. The constitutional neuropathic condition of Griesinger is the favorable soil for the development of numerous neuroses, such as hysteria, insanity, epilepsy, chorea, and the phenomena of catalepsy. The hysterical neurosis is the one best suited for the manifestation of the cataleptic phenomena. Congenital preformations, as Eulenburg terms them, of certain portions of the central nervous system predispose to catalepsy. In families in which in one or more members hysteria or catalepsy has developed, other nervous disorders—such as insanity, epilepsy, chorea, or alcoholism—are often found. In some cases epilepsy precedes the manifestation of cataleptic phenomena; in others epilepsy begins with symptoms of a cataleptoid nature. The inheritance of degenerative tendencies favor development of most neuroses.

> Description of a case studied by Dr. George E. de Schweinitz in a child, female, 2 1/2 years old, in which cataleptic phenomena, with a condition of automatism very similar to the manifestations exhibited by some hypnotized subjects, were witnessed for a period of several weeks. C. K. Mills ("System of Med.," edited by Pepper, vol. v, p. 316).
>
> Case of catalepsy alternating with violent mental excitement in a married woman. The attacks appeared at or about the menstrual period. During one of the menstrual periods she passed a membranous cyst of the uterine cavity and complained of dysmenorrhœa and menorrhagia. Recovery followed treatment of uterine disorder. Stone (Lancet, Apr. 20, 1901).

This nervous disorder is most frequent at puberty and from that period to the thirtieth year. A number of cases have been observed in children. Moti, referred to by Mills, records eleven cases met with in children from the fifth to the fifteenth year, the average being nine years.

> Quite well marked catalepsy is sometimes observed in young children of one

or two years when they are ill. Probably they fall into a sort of stupor; or often it seems that they are rendered hypnotic, as it were, by the presence of strangers. Strumpel ("Text-book on the Practice of Med.," p. 754, Eng. trans.).

Women are more likely to suffer from catalepsy than men, but the difference is not great. Of 148 cases collected by Puel, 80 occurred in females and 68 in males. Malnutrition, caused by insufficient or improper food, or conditions that interfere with digestion and assimilation, favor the development of catalepsy. Prostration following the acute fevers or profound mental or physical exhaustion would probably not give rise to the disease in a person who formerly had a healthy and normal nervous system; but in a neurotic subject such a cause might greatly enhance the predisposition, and with the addition of any emotional disturbance it would probably be sufficient to cause the development of the phenomena.

Strong and suddenly-induced emotion may be classed among the first of the exciting causes. It may be in the form of moral shock, fright, anger, profound sorrow, great apprehension of evil, intense mortification, or religious excitement.

The emotion is in the form of depressing moral affections, as chagrin, hatred, jealousy, and terror at bad treatment. Puel (Mills: Pepper's "System of Med.," vol. v, p. 318).

It is evident that any emotional influence that is great enough to disarrange suddenly the workings of the higher nerve-centres in a neurotic subject may be sufficient to produce various emotional manifestations, among which we may class catalepsy.

It is undoubtedly true that prolonged, depressing meditation and apprehension may give rise to the disease. The apprehension and uncertainty antedating and attendant upon childbirth may favor the development of the nervous state or even give rise to it if the labor is followed by complications or depressing conditions.

Case following the second confinement. Before the labor the woman had been very nervous, following it were a chill and rather high fever for a short time, and forty-eight hours later catalepsy with distinct hysterical symptoms developed. S. S. Cornell ("Psychological Med.," Mann, p. 470).

Painful menstruation, pregnancy, the parturient state, sudden suppression of menstruation, dysmenorrhœa, and masturbation are supposed to be causes of the disorder. Mills refers to reflex irritation as an exciting cause, and instances a case of preputial irritation, relieved by circumcision, occurring in the practice of Dr. James Hendrie Lloyd.

Case recorded by Austin, in his work on "General Paralysis," in which the cataleptic seizure was apparently due to fæcal accumulations. The attack disappeared promptly after the bowel had been emptied by means of an enema. Mills (Pepper's "System of Med.," vol. v, p. 318).

Traumatism, such as blows to the head or spine, may give rise to catalepsy. Eulenburg cites a case seen by Jamieson in which a blow on the right side of the back was followed by an attack. Periodic attacks of catalepsy have resulted from malaria, and yielded promptly to antimalarial treatment. Hammond mentions one case in which worms in the intestinal canal were the apparent cause. Gastro-intestinal irritation in general is a frequent cause of catalepsy as well as of hysteria. Mills mentions the fact that catalepsy may occur as an imitation of epidemic nervous disturbance.

Epidemic of icterus in children associated with catalepsy; the children allowed their limbs to remain motionless in whatever position the examiner

placed them. This condition persisted for about nine days, when it was followed by slow improvement. The liver was enlarged in all cases, but were not tender. Cases all recovered. O. Damsch and A. Kramer (Berliner klin. Woch., Mar. 21, '98).

Opium and anæsthetics have given rise to nervous conditions in which cataleptic phenomena have been prominent. Eulenburg, in discussing theory of the muscular condition in catalepsy, says: "The observation often made, that narcotics and anæsthetics, at a certain stage of their action, before the production of narcotism, may give rise to slight epileptic phenomena"; then adds in a footnote: "I have myself seen an exquisite case of *flexibilitas cerea*, alternating with trismus, opisthotonos, and general convulsions, in a patient poisoned by morphia (by 0.09 gramme—1 $^1/_3$ grains—of the hydrochlorate)" ("Cyclopædia of the Pract. of Med.," Ziemssen, vol. xiv, p. 379). Rosenthal refers to somewhat similar results following the adminstration of anæsthetics and poisonous doses of morphine.

In a somewhat ancient American medical periodical (No. Amer. Med. and Surg. Jour., vol. i, p. 74, '26) Charles D. Meigs, of Philadelphia, gives an interesting account of a case of catalepsy produced by opium in a man 27 years of age. The man had taken laudanum. His arms, when in a stuporous condition, remained in any posture in which they happened to be left; his head was lifted off the pillow and so remained. "If he were made of wax," says Meigs, "he could not more steadily preserve any given attitude." The patient recovered under purging, emetics, and bleeding. C. K. Mills (Pepper's "System of Med.," vol. v, p. 319).

Darwin, quoted by Meigs, mentions a case of catalepsy which occurred after the patient had taken mercury. He recovered in a few weeks.

[I have often observed a rigid condition of the limbs in patients while taking an anæsthetic. It is a frequent occurrence under such circumstances, and is seen just before the stage of narcosis is reached. J. T. Eskridge.]

It is important to bear in mind that a condition simulating catalepsy, trismus, and general convulsions may occur from lethal doses of morphine. Such phenomena from the poisonous effects of opium must be exceedingly rare, and are probably indirectly due to the peculiar nervous organization of the patient.

Hypnosis, induced by the Charcot method, such as having the subject stare for eight or ten minutes at a bright object held so as to cause the eyes to look upward in convergence is often attended by cataleptic phenomena: the so-called first stage of hypnosis of Charcot. I have never seen this condition in hypnosis induced by the Nancy, or suggestive, method, provided no suggestions were made to develop muscular rigidity.

Catalepsy occasionally occurs in association with insanity. It has been met with in connection with mania, melancholia, and paralysis of the insane. When it is observed among the insane it is most commonly found in the graver forms of melancholia, and in profound conditions of stupor. The mental condition under such circumstances is the cause of the cataleptic phenomena. One form of insanity, catatonia, first described by Kahlbaum, of Gorlitz, about twenty-three years ago, is always in its typical form attended by motor tension sufficiently marked to maintain the limbs in whatever position they may be placed for hours, or even a day or more, if we may accept the statements of Kahlbaum and Spitzka.

Finally, numerous organic diseases of the brain are sufficiently often attended with cataleptic phenomena to demon-

strate a causative relationship between the organic cerebral lesion and the manifestation of the motor tension. These phenomena have been seen more commonly as transient symptoms in tumor, abscess, hæmorrhage, and softening of the brain, and in meningitis. It is a common experience to find a cataleptoid condition suddenly develop in cases of organic disease of the brain. It is probable that partial cataleptic states of the muscles would be detected more frequently than they are were physicians to examine for them in every case of brain disease coming under their observation.

> Conclusions after a study of fifteen cases: Cataleptic states which develop in the course of psychoses are often slight, brief, and partial. With increase of muscle-tension and enfeeblement of voluntary psychomotor activity they are often due to enfeeblement of perception of fatigue and to the persistence of communicated motor images; they may develop in a number of mental maladies, especially in alcoholic delirium, melancholy, mental confusion, manias, periodic insanity, the delirium of degenerates, and in congenital or acquired mental feebleness; they may precede or follow an epileptic crisis; hysteria is rarely connected with them; there is no catatonia of Kahlbaum; and these states are easily simulated. Paul le Maitre ("Contributions à l'Etude des Etats Cataleptiques dans les Maladies Mentales," p. 96, '95).

Pathology.—The examinations of the bodies of some cataleptic subjects, who during life presented undoubted evidences of organic disease of the brain, have revealed certain gross lesions of the central nervous system, especially of the brain. These findings prove nothing in regard to the pathological anatomy of catalepsy, because the autopsies, held on the bodies of persons who during life presented distinct symptoms of catalepsy without evidence of organic brain disease, have been attended with absolutely negative results. We are, indeed, in absolute ignorance of the pathogenesis of catalepsy.

In regard to the theory of muscular rigidity and the wax-like flexibility of the limbs, observed as the most significant symptom of the phenomena of catalepsy, speculation has been rife. In the present state of our ignorance concerning the intimate nature of the subject, the most elaborate theories are only speculations.

In the normal condition the constant muscular tonus seems to be sufficient to adapt the muscles for lengthening and shortening without any disturbance of the harmony of action between the synergic and antergic groups of muscles concerned in extending and flexing the limbs. The nervous reflex concerned in maintaining the nicely-adaptable muscular tonus is composed of the muscle-nerves and the motor cells of the spinal cord. We have every reason for believing that the higher nerve-centres control, probably by inhibition, the lower ones; and that in case the inhibitory power of the higher centres over the lower is impaired or lost, the latter centres may run riot and cause exaggerated muscular tonus. In catalepsy the highest nerve-centres seem to lose their inhibitory power over the lower; and hence we find an increase of the muscular tonus. Did we not have to go further and explain certain other phenomena observed in catalepsy we should have little difficulty in accepting the theory that impairment or loss of the inhibitory power of the higher nerve-centres is the direct mechanism by which this affection is produced. In other and widely different conditions from the one under consideration, in which we know

that the communication between the higher and lower nerve-centres is made difficult or entirely impossible, as witnessed in lesions in the upper portion of the cord and in the motor regions of the brain, the muscular tonus is not only increased, but the deep reflexes are also increased and the typical wax-like condition of the muscles, as observed in catalepsy, is rarely seen. In catalepsy, on the other hand, while the muscular tonus is increased, the deep reflexes are diminished. It is a curious fact that comparatively mild passive motion will cause the limbs to mold themselves in various positions in catalepsy; yet a far greater stimulant to muscles, muscle-nerves, and cutaneous nerves—the strongest faradic or galvanic current—fails to accomplish the same result.

[This does not seem to me so difficult of explanation as Eulenburg seems to infer. By passive motion the limbs are not made, even in catalepsy, to assume different positions on account of any stimulation, either direct or indirect, communicated to any reflex nervous apparatus, but the change in position of the limb is the result of mechanical force, applied usually to the best advantage to accomplish the desired result. On the other hand, when electricity is applied to a group of muscles to cause flexion or extension of a limb, the power does not act to the same advantage to cause the limb to assume different positions as is the case when passive motion is employed; besides in the use of strong currents of electricity diffusion of the currents to a greater or less extent takes place, and in consequence, indirect stimulation of the antagonistic group of muscles results. J. T. Eskridge.]

Rosenthal thinks the waxy mobility is due to reflex contraction. Eulenburg, in commenting on this conclusion, states: "To the latter view we are at all events driven; but just the 'how?' and the 'wherefore?' of the form or reflex action is, alas! still unknown to us."

At the present day it is impossible to account for all the phenomena that occur in catalepsy. That it is a symptom of a disordered condition of the highest nerve-centres, the cerebral cortex, seems to be a fact. That during the attacks, the nervous system, especially the spinal representatives of it, is in an excitable state, with a disarrangement of the normally-adjusted influence of the higher nerve-centres over the lower appears to be equally true. When the pathology of hysteria is thoroughly understood then we shall be able to explain many, if not all, of the manifestations observed in catalepsy. Until then we may observe and gather facts to be utilized.

[No one in discussing the theory of the mechanism of the phenomena that occur in catalepsy has apparently taken into account the possible influence of suggestion. J. T. Eskridge.]

Treatment.—This should consist of measures for the relief of the paroxysm, and the employment between the attacks of those agents most likely to aid in toning up the nervous system, together with such changes in the daily life and surroundings of the patient as are best adapted to improve the mental state.

Two cases showing the beneficial effects of thyroid medication after the complete failure of other methods of treatment.

Conclusions: 1. That in conditions marked by inhibition of sensory, motor, and mental activity, without gross organic lesion, such as are met with in catatonia and in certain types of stuporous insanity and melancholia, we may expect benefit from thyroid medication, judiciously used.

2. That the effects of thyroids in full dose bear a striking resemblance to many of the symptoms of Graves's disease, namely: orbicular weakness, consecutively conjunctivitis, skin eruptions, and temporary bronzing, without icterus

of the eyes, profuse local fœtid sweats, subjective sense of heat and thirst, excessive metabolism, decided tachycardia, and the absence of any fixed relation between pulse-rate, respiration and temperature. Joseph G. Rogers (Amer. Jour. of Insanity, July, '97).

During the paroxysm it is always well to unload the bowel with a high enema, consisting of about 3 pints to 2 quarts of warm water to which 1 or 2 ounces of the tincture of asafœtida have been added. After the bowels have been thoroughly opened in the manner indicated, $^1/_2$ ounce of the tincture of asafœtida in about 4 ounces of water may be thrown into the bowel high up and allowed to remain. If the attack is severe 15 or 20 grains of chloral-hydrate may be added to the tincture of asafœtida for the small enema, in which case milk should be used instead of water. If the stomach contains any undigested food $^1/_{16}$ grain of apomorphine may be given hypodermically. A free emesis even when there is no undigested food in the stomach may aid in aborting the paroxysm.

To shorten the attack inhalations of amyl-nitrite or an hypodermic of $^1/_{100}$ grain of nitroglycerin may be employed with advantage. Cool applications to the head and passing a piece of ice up and down the spine several times and following this by briskly rubbing the spine with a coarse towel greatly aid in establishing reaction. A mustard plaster to the nape of the neck and one over the stomach have the same effect. Diffusible stimulants, especially ammonia, may be used with advantage.

During the intervals the treatment and general management are of considerable importance, and should receive as much attention as in a case of hysteria. In the first place careful attention should be paid to the food and organs of digestion. The diet should be nutritious, easily digested, and abundant. If necessary, digestion may be aided by the ordinary means. A free action of the bowels should be obtained each day. Iron, arsenic, quinine, and strychnine should be employed in the building-up process.

Systematic, but not violent or overfatiguing, exercise should be insisted upon for all those who are not too weak. A little gymnasium can be arranged in most bed-rooms, and the beneficial results to be derived from regular exercise for a few minutes night and morning can scarcely be estimated until after one has tried it. A cool or cold sponge- or plunge- bath should be indulged in night and morning, following the exercise. At the same time the patient should be kept in the open air as much possible.

If the patient is a child or young adult the education should be judiciously supervised, and all oversentimental and emotional books excluded. Companionship for such patients, be they children or adults, is of great importance. In short, everything in reason that tends to develop muscle and improve the mental and physical condition of the patient should be encouraged, while exhaustion, depressing agents, poor nutrition, and emotional excitement should be avoided if possible.

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